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# "For the Promotion of the Mechanic Arts"

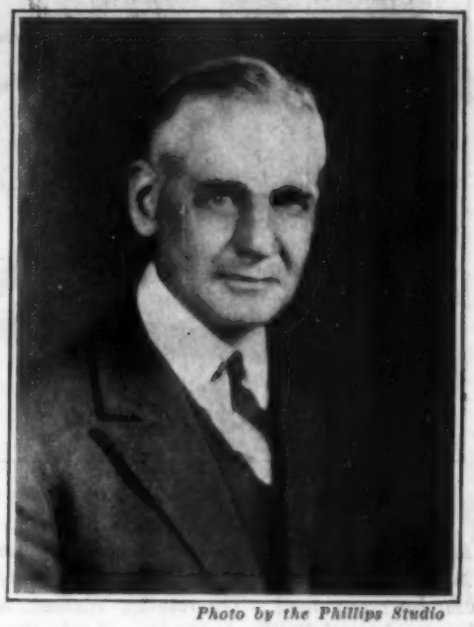


Photo by the Phillips Studio

By William C. L. Eglin
President, Franklin Institute

## *One hundred years of service to industry*

THE occasion of the one hundredth anniversary of the Franklin Institute seems to be a fitting one on which to tell those to whom the Institute is only a name something of its history and of its plant for the future. Hundredth anniversaries of towns or colleges or birthdays of great men are not uncommon even in so young a country as ours, but it is something out of the ordinary when an organization devoted to the mechanic arts can celebrate such an event, for the mechanic arts are even younger.

In our day, and more particularly since the World War, the importance of the mechanic arts in the scheme of modern civilization is pretty generally understood. One hundred years ago this was most certainly not the case. In the year 1824 in the city of Philadelphia two young men individually conceived the idea of forming a society, "For the promotion of the mechanic arts," as they put it. These men, Samuel Vaughan Merrick and Professor William Hypolitus Keating of the University of Pennsylvania, were brought together by a mutual acquaintance and started with zeal to put their plan into practical form.

An organization meeting was held on February 5, 1824, and was entirely successful. Eventually an act to incorporate The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, was passed by the Pennsylvania Legislature and signed by the governor. James Ronaldson, owner of the first type foundry in this country and largely interested in the public welfare of Pennsylvania, was the first president.

A year later the cornerstone of the Hall of the Franklin Institute was laid on Seventh Street between Market and Chestnut Streets with full Masonic rites. The original building is still in use.

The main purpose of the founders was as stated in their charter, the promotion of the mechanic arts, and they set about it by instituting lecture courses and establishing schools. The first course of lectures, three nights a week, for twenty-one weeks, was given by three men: William H. Keating, whose subject was Chemistry; Robert M. Patterson, who talked on Natural Philosophy and Mechanics; and William Strickland, who lectured on Architecture.

The lecture courses have continued to the present day and the lecturers number some of the greatest scientists of the last hundred years. The most recent was Sir Joseph John Thomson, O.M., F.R.S., who delivered five lectures on "The Electron in Chemistry."

Lecture courses having been established the next move was to start the schools for which the Institute has been famous. The first of these was a drawing school for members' sons and apprentices. It was epened in October, 1824, and was directed by John Haviland, assisted by Hugh Bridport. Six months later a mathematical school for members, their sons and apprentices, was started with Levi Fletcher in charge.

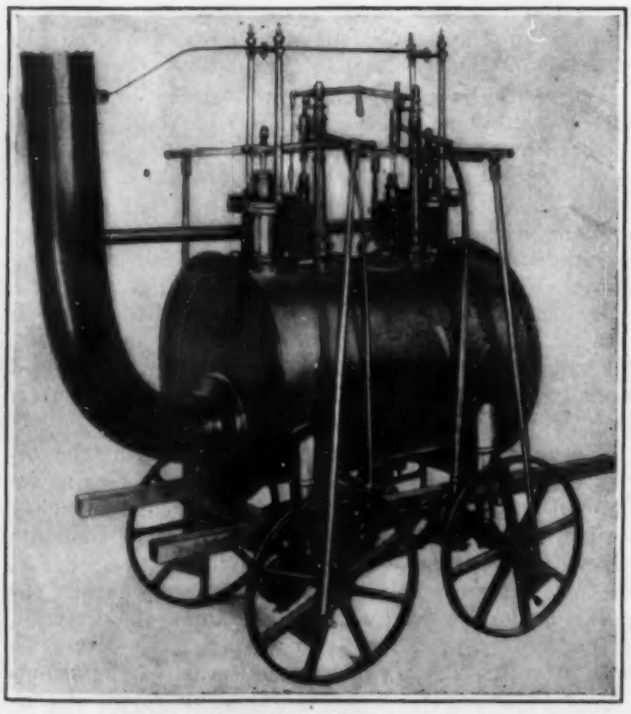
During 1826 a high school was established in which were taught mathematics, drawing, geography, history and languages. It continued with some three hundred pupils until 1832 and was the predecessor of the Central High School.

In connection with the instructional work of the Institute it should be borne in mind that there was no competition with the colleges, which were engaged solely in turning out scholars. The founders of the Institute had no fault to find with this activity of the colleges, but they did sense clearly the need of some means for educating the men who would later assume the direction of the rapidly growing American industries, then in their infancy. There can be no question of the soundness of their belief. The experience they gained contributed materially to the success of such institutes in other cities as the Cooper Institute in New York, the

*Franklin's imposing stone*

Armour Institute in Chicago and the Lowell Institute in Boston. As to the students themselves, two examples can be mentioned: Thomas U. Walker, a young bricklayer, started in the Institute schools the upward climb that culminated in his designs for the National Capital at Washington and the buildings for Girard College. A student better known to readers of the *American Machinist* was Dr. Coleman Sellers, in after years a president of the Institute.

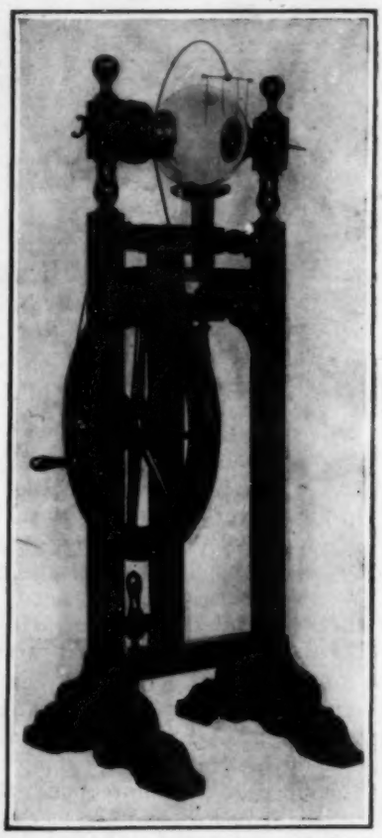
Still another of the early plans to promote the mechanic arts was the holding of exhibitions to acquaint the public with new inventions and improvements in articles of daily use. The first exhibition was held in October, 1824, in Carpenters' Hall. Thirty premiums were offered for specimens of blister steel, bar iron, broadcloths, domestic carpetings, etc. There were three hundred exhibits and ten silver and two bronze medals were awarded. In 1825 there were more than twice as many exhibits and nearly three times as many premiums were offered. A year later the exhibition was still larger and was visited by 34,000 people.



*Model of Stephenson's No. 1 locomotive used on the Stockton & Darlington Railway in 1825*

A Journal was established very early in the history of the Institute and continues to this day as a respected record of scientific achievement. It is probably better known abroad than in the United States.

Many engineering investigations have been made by members and by committees of the Institute. Perhaps the most important resulted in the adoption, fifty years ago, of the Sellers or Franklin Institute Standard Screw Thread.



*Electrical machine used by Franklin in experiments performed about 1750*

So much for the history of the Institute and what it stands for. What of the future? Physically, there is vital need of enlarged facilities. The building constructed a hundred years ago is inadequate. A very desirable location on 19th Street between Cherry and Race Streets is owned by the Institute and has appreciated several times in value since it was purchased. Complete plans for new buildings on this plot have been drawn but they will probably be modified before construction actually begins. It is the hope that they will be monumental in character, containing no perishable construction material, and that they will be so redesigned as to conform to architectural standards that have shown themselves to be proof against time.

The medals that have for many years been considered the stamp of approval on a new method or device will be continued and others may be added from time to time. The membership will be increased and there is under contemplation the formation of a new class of membership. To this class will be eligible young men nominated by manufacturers in the Philadelphia district. Their dues will be paid by their employers and the chance to improve their mental and technical equipment will be afforded by the Institute.

The support of research work and research investigators will be stimulated as the new laboratories are finished and larger funds become available to provide facilities and financial support for genuine research men who would otherwise be compelled to let their talents lie idle while they struggle to earn a living.

# Salt Baths for Steel Treating

By Sam Tour

## Consideration of the reasons for employing liquid heating mediums—Design of proper furnaces and containers for salt baths — Salt baths for the heat treatment of various steels

THIS paper is the third one on this subject contributed by the author to the American Society for Steel Treating. As in previous years, the attempt is made to give a clear and as complete a description of the subject as possible, and to supply accurate data and information. The author's intention is to give in an unbiased manner the results of his years of practical plant experience and experimental and development work and study of the subject. Having no pecuniary interest in the general adoption or rejection of the salt bath method for heat treating, the author is guided entirely by the proven results of his work, and has no reason for unduly emphasizing either the advantages or the disadvantages of any particular mixture of salts for salt baths.

Much of the data available to the public on the subject of salt baths at the present time, is of the nature of sales propaganda and as such is teeming with misleading statements, intentional exaggerations and even with untruths.

Liquid baths for heat treating are employed for various reasons. The most common reasons are:

(1) A desire for a non-scaling, non-oxidizing method of heat treating
(2) A desire for a rapid method of producing a skin or surface hardness similar to a thin case hardening
(3) A desire for a more uniform degree of heating of the work
(4) The elimination of troubles due to warping and cracking
(5) An increase in volume of production by more rapid heating
(6) A desire for greater uniformity of product
(7) Lower production costs.

Liquid heating mediums, if properly selected and operated, can usually accomplish a fulfillment of a majority of the above requirements. It is, however, not possible to say, at the present time, that the oven type of furnace for heat treating can be replaced. Consideration should be given to each and every one of the items shown above as reasons for the employing of salt baths before any installation is made.

Often, it is of vital importance that work be heat treated without any deterioration of the surface. Again it is often desired to heat a piece so as to obtain a thin skin or surface hardening effect. The surface condition, being the first one to come to view, is the first consideration in the average tool hardening room. Although it is a mistake to consider that "a clean tool is a good tool," yet it is not so often a mistake to consider that "a scaled tool is a ruined tool." The preservation of the surface of the work is then one of the first requirements of a heating medium. It is usually not only necessary to preserve the surface appearance, but also, except when case hardening, to preserve the surface composition by the prevention of any carburization or decarburization. This requirement is really the one upon which the greatest emphasis should be placed and is often the one which gives the most trouble. The first questions to be raised and answered before one goes any further in regard to the advisability of adopting any specific liquid medium are, "will it scale, pit, corrode, decarburize, cyanide, or carburize the steel today, tomorrow or after continuous operation for a period of several months?" These questions must all be answered satisfactorily before it is advisable to go into the matter further. Each of the above questions will be discussed in more detail below.

A paper presented before the sixth annual convention of the American Society for Steel Treating, Boston, Mass., Sept. 22, 1924.

### More Uniform Heating With Liquid Bath

There is no doubt that liquid bath heating will give more uniform heating of a charge of work than any other type of heating. It is a fallacy, however, to consider that a liquid bath is of the same temperature throughout. The convection currents in a molten bath are the natural result of non-uniformity of temperature in that bath. A molten bath is continually losing heat at the top by radiation into the atmosphere, and when in use, by the carrying away of heat with the work. Normally, then, there will be a tendency towards a higher temperature at the bottom of the bath than at the top, in spite of the fact that convection currents continuously carry the colder liquid to the bottom. There will, of course, be a similar variation between the edge and the center of the bath. In installing and in operating a molten bath, these things must be considered and precautions taken to overcome the difficulties as much as possible. The work placed in the bath must not be allowed to touch the walls of the container. The thermocouple should be properly placed so that it gives an accurate indication of the temperature of the major portion of the bath. When these precautions are taken, the temperature of the bath and temperature of work coming out of the bath can unquestionably be kept more uniform than an oven furnace.

Troubles due to warping and cracking are often traceable to non-uniformity of heating or to an improper rate of heating for hardening. In these cases, the trouble can usually be overcome by the use of properly selected liquid baths and the proper operation of them. The accomplishment of this, however, calls for an understanding of the thermal reactions taking place

in the bath and in the work, and the exercise of a certain amount of judgment on the part of the operator. The claim is often made that cracking and warping are due to the shock of too rapid heating during the first few seconds in a furnace, and that cracking and warping of this nature is entirely eliminated in salt baths by the solid film that forms on the work when it is first immersed in the bath. It is further stated that while this solid film is melting, the work heats relatively slowly; as the film gets thinner, the rate of heat increases; and when the film is entirely molten, the work heats faster.

A little analysis of this statement seems worth while. In treating plain carbon-steel tools, a chloride or chloride-carbonate mixture is generally used. Consider a mixture with a melting point of 1,300 deg. F. and operating at a temperature of 1,425 deg. F. A tool at room temperature is plunged into this bath. The amount of molten salt necessary to form the solid film must first be cooled from 1,425 to 1,300 deg. F. The tool must then extract from this quantity of salt its latent heat of fusion, and it must then in addition cool this solid film down still lower before the solid film can in any way begin to act as a protection of the tool against too rapid heating. The rate of heating during this process is certainly more rapid than could be obtained by placing the tool in an oven furnace at 1,425 deg. F. Even after the above process of film formation is complete, the rate of heat transfer into the piece is greater than could be attained in an oven furnace, and anyone can prove this to their own entire satisfaction by running actual tests with thermocouples inserted in test tools. Good practice does not permit the placing of a cold piece directly into a furnace at a cherry-red heat.

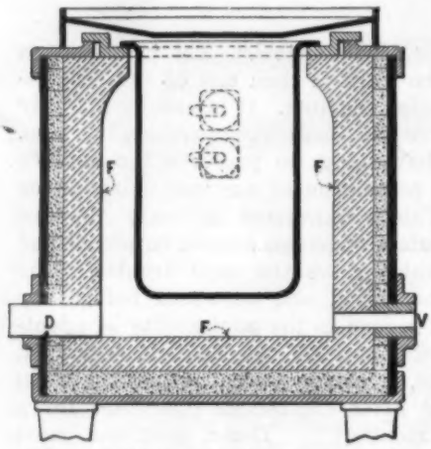


*Fig. 1—Diagram of furnace using gaseous fuel*

The fact that warping and cracking during initial heating is less common in liquid baths than in oven furnaces, is probably due to the more uniform heating and support of the work in the liquid bath and not necessarily the result of any lesser rate of heating. If the oven furnace were of the vertical muffle type with open top, and if the work were suspended in this muffle from the top in a manner similar to the method used in a liquid bath, practically the same results would be obtained regarding warping and cracking, providing the muffle furnace were operated at the same temperature as the liquid bath. By proper insertion of the work in molten baths or by proper preheating of the work before such insertion, a great deal of the warping and crackfng due to non-uniformity of heating can be eliminated.

There is no doubt but that a molten bath will heat work faster than an oven or mufflle furnace and therefore the work output per furnace can be greatly increased by the installation of the liquid heating medium method of treating. The proper installation and intelligent operation of molten baths allows for a much more accurate and more positive control of temperatures than do oven or muffle furnaces, and therefore the uniformity of the product from day to day can be increased by the use of such baths. The temperature lag between the furnace and the pyrometer is very small and any given temperature can be very accurately maintained with minimum attention. The much more rapid heat transfer from molten medium to the work, than from oven or muffle furnace atmosphere to the work results in increased production per unit of installation and per employee, and in decreased production costs. Often the liquid bath method of heat treating proves the most economical for miscellaneous work not requiring great care as to surface conditions, such as in the heat treatment, in the rough, of miscellaneous parts of alloy and structural steels.

To obtain maximum production at lowest cost, any furnace must be properly designed. Mention was made previously of the heat distribution in a molten bath and of the heat losses from a molten bath. Since the zone of maximum heat loss is at the top, it necessarily follows that the zone of maximum heat input should also be at the top. Containers are often caused to bulge and to crack by the internal pressure resulting from the expansion of the solid salt. By having the furnace hottest at the top the salt melts there first and relieves the pressure below. Efficient furnace operation is always obtained by placing vents so as to remove the gases from the zone of minimum heat input requirements. This means that a molten bath furnace should be top-fired and bottom-vented. Other requirements regarding furnaces are:

(1) The combustion chamber must be free from salt at all times
(2) Separate vents should be provided for the combustion gases and the bath fumes so that no fumes will at any time find their way into the combustion chamber
(3) The furnace should be provided with a bottom drain so that salt may be drained out in case of failure of container
(4) Means should be provided for accurate control of fuel to air mixers, so as to effect accurate control of the atmosphere in the combustion chamber
(5) The furnace cover should be such as to prevent molten salts dripping from the work from seeping down around the edge or rim of the pot into the combustion chamber
(6) The furnace should be provided with a hood so as to carry away any fumes, to prevent undue spattering and to prevent undue heat loss by radiation.

Forced draft on the hood of a salt bath is not necessary with a proper bath and is not desirable with any bath except cyanide, as it greatly increases the heat loss from the surface of the bath. A furnace designed to meet the above requirements for gaseous fuel is shown in Fig. 1. Furnaces should be so designed as to have no direct impingement of flame on the container. This calls for tangential burners kept in proper adjustment. In using gaseous fuel, it is some times difficult to determine whether proper air-gas mixture is being obtained in the furnace. A valuable aid to determining this is in the use of a pilot-light from a pet cock tapped into the burner just outside the furnace.

Containers should be selected with a view toward maximum heat efficiency of the installation as well as

toward heat hours service. The thinner the walls of the container, the higher will be the heat efficiency, the shorter will be the time for melting and bringing up to heat, and the easier it will be to control the bath temperature. The life of a container is dependent upon its resistance to the action of the bath, to the strains set up on heating and cooling and to the amount of external oxidation and chemical attack. Cooling a bath when the temperature gets too high, by shutting off the fuel and leaving the air on, should never be practiced. Strains in containers during heating and cooling arise from expansion and contraction of the container itself, from expansion of the solid salt within during heating and from the fluid pressure of the molten salt. Cast iron containers develop strains due to permanent growth at a red heat. The requirements for a container are:

(1) That they should be as thin-walled as possible
(2) That they should be as strong as possible at the operating temperature
(3) That they should be as resistant to oxidation as possible
(4) That they be of materials other than cast iron if to be operated at a red heat
(5) That they should be resistant to chemical reaction by the salt mixture.

The available method or methods of construction of containers are dependent upon the sizes of container required. Pressed steel pots are not obtainable in very large sizes nor are they usually obtainable in rectangular shapes. Wherever it is possible to obtain a pressed steel pot for the work, such a pot is generally the most economical. For larger pots, cast-iron, cast-steel and special heat-resisting alloys and welded-steel pots are available. For temperatures up to a red heat, cast iron or semi-steel is satisfactory. For temperatures above 1,300 deg. F., cast-steel, special-alloy or welded-steel pots are necessary. In all cast pots, the main problem is to obtain them free from porosity. In properly operated furnaces with careful and proper atmospheric control, cast-steel and welded-steel pots will prove the most economical. If, however, the furnace atmospheres are not properly controlled, then some alloy heat-resisting material becomes necessary.

Various salt mixtures of nitrates, nitrites, carbonates and chlorides are used for heat treating. In Table I is given a number of such mixtures, their composition, melting point and satisfactory working range, together with a few explanatory remarks. In Table II is given the composition and melting points of the salts used in the mixtures in Table I.

Attention is called to the fact that there is considerable variation among different authorities as to the melting points of a number of the more common salts used in salt-bath mixtures. For example, sodium chloride is shown in Table I as having a melting point of 1,488 deg. F., yet the literature shows considerable variation from this as follows:

| Investigator | Reference | Temperature Deg. F. |
|---|---|---|
| Wolters | Landolt and Bornstein | 1467 |
| Rambach | Landolt and Bornstein | 1506 |
| Aureggi | Landolt and Bornstein | 1483 |
| ..... | Physico Chem. Tables | 1422 |
| Day, Sosman and White | Smithsonian Tables | 1472 |
| Le Chatelier | Landolt and Bornstein | 1432 |
| Batsford | Industrial and Engineering Chemistry, Vol. 15, p. 1272 | 1499 |
| Lantsberry | Journal Soc. Chem. Ind. 39, p. 37 | 1445 |
| Olsen | Chemical Annual | 1479 |

Usually, the best bath composition is that which represents the eutectic mixture of the various constituents of the bath. In Fig. 2 are equilibrium curves for most of the mixtures shown in Table I. In regular practice it is not possible to make up mixtures of salts shown

**Table I—Salt Mixtures**

| Composition | | Melting Point Deg. F. | Usable Range | Remarks |
|---|---|---|---|---|
| 55% $NaNO_3$+45% | $NaNO_2$ | 430 | 430– 900 | ..... |
| 55% K $NO_3$+45% | $NaNO_2$ | 425 | 425– 900 | ..... |
| 28% NaCl+72% | $CaCl_2$ | 940 | 1000–1600 | Decarburizes above 1500 |
| 50% $Na_2CO_3$+50% | K Cl | 1040 | 1100–1500 | Breaks down above 1500 |
| 50% NaCl+50% | $K_2CO_3$ | 1040 | 1100–1500 | Breaks down above 1500 |
| 35% NaCl+65% | $Na_2CO_3$ | 1150 | 1200–1500 | Breaks down above 1500 |
| 50% $CaCl_2$+50% | $BaCl_2$ | 1112 | 1200–1650 | Decarburizes above 1500 |
| 22% NaCl+78% | $BaCl_2$ | 1175 | 1250–1650 | Decarburizes above 1500 |
| 54% NaCl—56% | K Cl | 1228 | 1300–1600 | Decarburizes above 1500 |

by these curves and get absolute checks on the freezing temperatures shown. This is due to various impurities in the salts and to variations in the composition resulting from losses during initial melting. In general, it is not possible to use a salt-bath mixture at temperatures close to its melting point, because of the formation of a crust of solid salt on the surface, due to the surface-cooling action. The working range then of a salt mixture will be from a temperature possibly 50 deg. F. above its freezing point up to a temperature at which fuming, scaling, decarburization, or some other objectionable reaction begins to take place.

For tempering purposes, there is not much choice between a mixture of sodium nitrate and potassium nitrate and a mixture of sodium nitrate and sodium nitrite. They are both usable over about the same range of temperature. They cannot be used for the tempering of high speed steel at 1,100 or 1,500 deg. F. because at this temperature, they corrode the steel very rapidly. For finely finished work, these salts cannot be

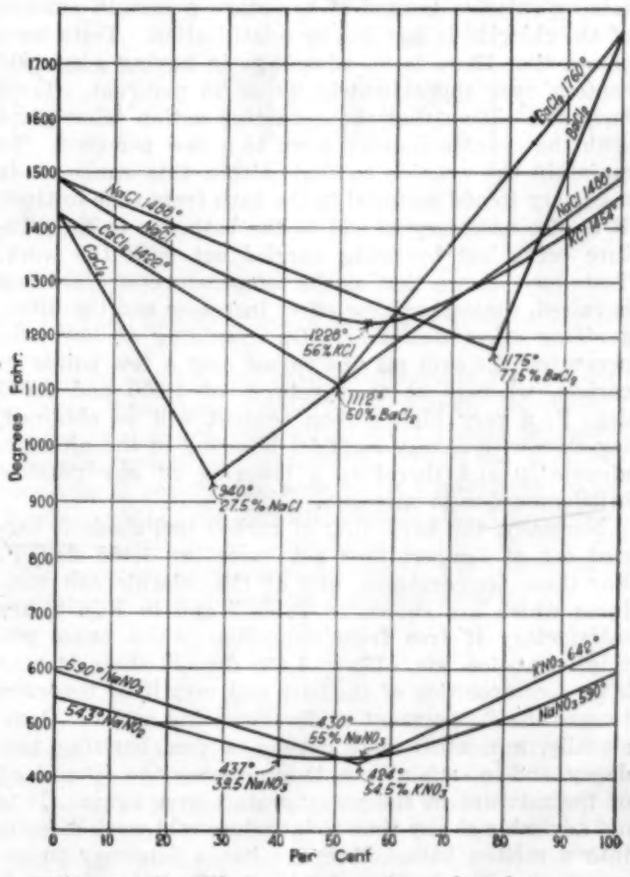



*Fig. 2—Equilibrium curves for salt mixtures shown in Table I*

used for tempering above 800 or 850 deg. F. because they have an oxidizing action on the steel. For tempering of high-speed steels, the mixture of calcium chloride and sodium chloride is best, although the mixture of potassium chloride and sodium carbonate can also be used. These chloride and chloride-carbonate mixtures do not deteriorate at this temperature and, if free from impurities such as sulphates, do not pit or corrode the work or have any cyaniding, carburizing, or decarburizing action.

Cyaniding is carried out for the purpose of producing a skin or thin surface hardness on steel. The temperature at which the bath is operated is dependent upon the steel being treated and the amount and depth of case desired. For cyaniding work, straight sodium cyanide or a mixture of sodium cyanide, sodium chloride and sodium carbonate are used. Sodium cyanide rapidly deteriorates on heating, with the formation of sodium carbonate and the liberation of the cyanogen, so that the cyanide content of the bath decreases while the carbonate content increases. If the mixture containing chloride is used at the start, a certain amount of the chloride is lost due to volatilization. Tests have shown that there is no advantage in having a cyanide content over approximately 20 or 25 per cent. Tests have also shown that the cyaniding action takes place with the cyanide content down to a few per cent. To maintain the cyanide content within this range, it is necessary to add material to the bath from time to time. It is also necessary to add to the bath due to the mixture being lost by being carried out with the work. Tests have shown that as the temperature of cyaniding is raised, the carburizing effect increases and the nitrogenizing effect decreases. On cyaniding at low temperatures, the skin may be raised only a few points in carbon, whereas at temperatures of 1,550 and 1,600 deg. F. a very high carbon content will be obtained, together with a very material lowering of the nitrogen absorption and therefore a lowering of any possible brittleness due to nitrogen.

**Table II—Salts**

| Name | Formula | Melting-Point Deg. F. |
|---|---|---|
| Sodium Nitrite | $NaNO_2$ | 543 |
| Sodium Nitrate | $NaNO_3$ | 590 |
| Potassium Nitrate | $KNO_3$ | 642 |
| Potassium Cyanide | KCN | 1035 |
| Sodium Cyanide | NaCN | 1040 |
| Calcium Chloride | $CaCl_2$ | 1422 |
| Potassium Chloride | KCl | 1454 |
| Sodium Chloride | NaCl | 1488 |
| Sodium Carbonate | $Na_2CO_3$ | 1560 |
| Potassium Carbonate | $K_2CO_3$ | 1670 |
| Barium Chloride | $BaCl_2$ | 1760 |

Normally, the hardening of carbon tool steels is carried out at temperatures not exceeding 1,450 deg. F. For these temperatures, any of the chloride salt mixtures which are shown in Table I and in Fig. 2, are satisfactory if free from impurities which cause pitting, corrosion, etc. Up to 1,450 deg. F. there is very little decomposition of the bath and very little tendency toward the development of decarburizing action. Occasionally, a mixture may develop a decarburizing tendency, and in such a case, it is necessary to discard all of the mixture in the pot and start over again. It is not advisable at any time to introduce cold work directly into a molten bath. Moisture has a tendency to accumulate on the surface of cold work and if moist work is introduced into the bath, an explosion may result. Resistance to sudden heating is much greater at temperatures around 400 deg. F. than at room temperatures, and for this reason, in addition to eliminating the danger from explosion due to moisture, work should be preheated to 400 or 500 deg. F. before being introduced into a molten bath. In case a very expensive, complicated, and rather bulky tool is to be hardened, it is well to preheat it up to approximately 1,000 deg. F., dropping the bath temperature as low as possible before introducing the work into it and then raising both bath and work to the proper temperature. This procedure is also quite desirable where it is desired to minimize growth and shrinkage.

For the hardening of alloy steels which have proper hardening temperatures up to 1,450 deg. F., the same baths are available as for the hardening of carbon tool steel. At 1,500 deg. F. there is an increased amount of fuming of these baths and at higher temperatures than 1,500 deg. F. the decarburizing tendency of the bath increases with its use. In hardening alloy steels, it is usually necessary to soak them at the hardening temperature for a much longer period of time than plain carbon steels, and accordingly, the decarburizing action of the bath becomes more and more noticeable on the finished work. Above 1,500 deg. F. the chloride-carbonate mixtures begin to break down, to decarburize the steel, and to form a black coating on it which is mostly composed of carbon and iron oxide. It has been stated that the addition of small amounts of carbonates to the regular chloride mixtures results in a decrease of the fuming. Whether or not any such result is obtained is questionable, but such practice does result, however, in a tendency toward scaling and decarburizing similar to that which occurs in regular chloride-carbonate mixtures. For temperatures above 1,500 deg. F. the mixtures of barium chloride and sodium chloride or of barium chloride and calcium chloride are the most adaptable. Due care must be given in all cases to the decarburizing action which will result after long use of the baths.

For the high temperatures involved in the best treatment of high-speed steel, the number of satisfactory salt mixtures are few. The barium-chloride bath was developed and described in detail many years ago, but has never been a real success due to container troubles, to deterioration of the bath, to the developing of pitting and to the excessive fuming at temperatures of 2,250 deg. F. or higher.

**Table III—Fluorides**

| Composition | | Melting-Point Deg. F. |
|---|---|---|
| Potassium Fluoride | KF | 1450–1650 |
| Sodium Fluoride | NaF | 1800 |
| Barium Fluoride | $BaF_2$ | 2340 |
| Calcium Flouride | $CaF_2$ | 2375 |
| Magnesium Fluoride | $MgF_2$ | 2550 |
| 63.5% KCl+36.5% KF | | 1121 |
| 72.2% NaCl+27.8% NaF | | 1247 |
| 67.5% KF+32.5% NaF | | 1292 |
| 34% Ba $Cl_2$+66% $BaF_2$ | | 1728 |

The use of fluoride salts for these high temperatures has been suggested. The melting points of various fluoride salts and salt mixtures are shown in Table III. These figures were largely taken from Landolt and Bornstein. Three of these mixtures, namely, potassium fluoride and sodium fluoride, potassium chloride and potassium fluoride, and sodium chloride and sodium fluoride, have been studied. In each case it was found

that the molten bath attacked iron very rapidly even at as low a temperature as 1,600 deg. F., and that therefore the mixtures were not suitable for heat-treating purposes. The fourth mixture, barium chloride and barium fluoride, has not been given adequate tests for high-speed purposes.

The greatest drawback to the introduction of the salt-bath method for the heat treating of high-speed steel, is the difficulty with containers and this difficulty overshadows the difficulty of salt mixtures. Ordinary refractory materials cannot be used for containers for salt baths at these high temperatures because of the fluxing action of the salts on the silicates and metallic oxides of which refractories are composed. No metals or heat-resisting alloys have been developed as yet which will give satisfactory service. Furnace combustion chamber temperatures required to maintain a bath of 2,300 deg. F. are so high that the average container is fused. In some cases attempts have been made to protect the metallic container with a refractory covering. In this way, it has been possible to use pressed steel pots up to 8 in. in diameter, but their life is only about three days or three heatings, and the temperatures attained are only from 2,150 to 2,200 deg. F. Until a better container is available there can be but very little work done in the satisfactory development of salt baths for the hardening of high-speed steel.

Usually, the pitting and corroding of steel in chloride salt baths is a result of impurities in the form of sulphates which are present in the raw materials used in making up the baths. In order to eliminate this pitting action, the bath must be desulphurized. This desulphurization is best and most economically obtained by the addition to the bath of clean cast-iron chips. On the addition of these chips, there will result an evolution of gas. This gas rises to the top of the bath and bursts into flame with a peculiar cracking noise. This action is not detrimental to the bath. After heating the bath for a short time, for example, at 1,600 deg. F., and in contact with the cast-iron chips, these chips should be removed from the bath in order that they may not form a solid layer in the bottom of the container and result in local overheating of the container. There is no particular advantage in the use of ferro-manganese for desulphurizing, nor the use of low-sulphur steel chips.

### Decarburizing Action of Salt Baths

Mention has been made of the decarburizing action of salt baths in connection with alloy-steel hardening. This decarburizing action occurs even in a new bath containing carbonates, when operated at temperatures above 1,500 deg. F. A decarburizing action develops in chloride baths operated for periods of time at temperatures above 1,500 deg. F. and is possibly due to the formation of oxides and carbonates resulting from the decomposition of the salt bath material at the surface of the bath where it it in contact with the atmosphere. The intensity of the decarburizing action of a bath increases with the temperature at which the bath is operated and with the age of the bath. The depth of decarburization of the work is a function of this temperature and the age of the bath, together with the time period of immersion in the bath. Again, attention is called to the fact that "a clean tool does not make a good tool," and in spite of surface appearances, decarburization may be present.

Due to impurities in most of the salts available on the market, the fuming of newly-made salt mixtures is greater than of the mixtures that have been in use for a considerable time. New baths for steel hardening can be aged more rapidly, and the fuming action decreased, by heating to 1,600 deg. F. once or twice. If a bath develops an objectionable decarburizing action, the easiest way to correct it is to discard the entire lot and use fresh material. It must be remembered that certain salts are hygroscopic, and a bath composed of such salts absorbs moisture. This is especially true of calcium chloride and potassium chloride. Fumes from such baths settling on iron and steel work will collect moisture and will promote rusting. In cases where mixtures containing calcium chloride and potassium chloride are used, great care must be taken to have the furnace properly vented and to carefully wash the work after it is treated, so as to remove the last trace of salt.

# Helical Gear Problems Simplified

By Otto M. Burkhardt

ALL readers of the *American Machinist* whose occasional duty or pleasure it is to calculate helical gearing, were no doubt delighted to read the article entitled "The Solution of Helical Gear Problems" by Franz Szabo, published on page 391, Vol. 60. In the opinion of the writer, there is nothing that could detract from the value of graphical solutions of problems. However, gear dimensions have to be very accurate and all readers will have some respect for the old idea that dimensions should be calculated, not scaled. It is for this reason that every effort should be made to develop graphical methods in which the possible errors due to scaling are reduced to a minimum. The following method is offered because it will render graphical solutions far more accurate than before.

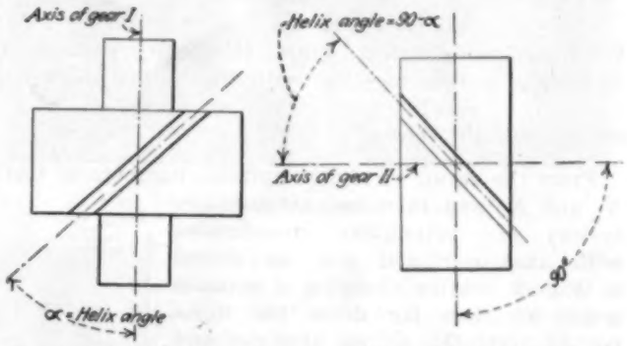



*Fig. 1—Helix angles of gears with axes at right angles*

The principal formulas developed for convenient calculation of helical gears with parallel axis are

$$D_1 = \frac{N_1}{p \cos a} \quad (1)$$

$$D_2 = \frac{N_2}{p \cos a} \quad (2)$$

in which $D_1$ and $D_2$ are the pitch diameters of the gears, $N_1$ and $N_2$ are the numbers of teeth in the respective gears, $p$ is the normal diametral pitch, and $a$ is the helix angle.

With the distance between centers $C$, the normal diametral pitch, and the ratio given, there is no diffi-

culty in obtaining the helix angle $a$ and the diameters $D_1$ and $D_2$.

$$D_1 + D_2 = 2C = \text{Twice the center distance}$$

$$\frac{N_1}{N_2} = R = \text{Ratio}$$

$$D_1 = 2C - D_2 \quad \text{and} \quad N_1 = RN_2$$

Substituting these values in equation 1, we obtain

$$2C - D_2 = \frac{RN_2}{p \cos a}$$

Substituting for $D_2$ the equivalent given in equation 2,

$$2C - \frac{N_2}{p \cos a} = \frac{RN_2}{p \cos a}$$

$$2C\ p \cos a = N_2(R + 1) \quad \text{hence}$$

$$\cos a = \frac{N_2(R + 1)}{2Cp}$$

Substituting this value in equations 1 and 2,

$$D_1 = \frac{2CN_1}{N_2(R + 1)}$$

$$D_2 = \frac{2C}{R + 1}$$

A similar solution for the determination of dimensions of helical gears with their axis at right angles to each other, is altogether too intricate to be useful for an engineer. For this reason cut and try methods have to be used. Mr. Szabo's method, when somewhat elaborated, can be made to yield the determining dimensions very accurately if the following method is used:

From Fig. 1 we note that the fundamental equations for gears with axes at right angles should be

$$D_1 = \frac{N_1}{p \cos a} \qquad (1a)$$

$$D_2 = \frac{N_2}{p \cos (90 - a)} \qquad (2a)$$

When designing helical gears, the center distance $C$ is usually known, together with the normal diametral pitch $p$, and the ratio $\frac{N_1}{N_2}$.

From the ratio, we choose suitable numbers of teeth $N_1$ and $N_2$ and then use an ordinary system of rectangular co-ordinates with axes $o$–$x$ and $o$–$y$, as shown in Fig. 2. After choosing a suitable scale, we then lay down the number of teeth $N_1$ as an abscissa and $N_2$ as an ordinate, giving the intersecting point $P$. Knowing the gear center distance $C$ and the normal diametral pitch $p$, we also know the numerical value of $2Cp$.

A straight line representing the value $2Cp$ should be so fitted in that it passes through $P$, while its ends lie in the $x$ and $y$ axes. The point $P$ divides the $2Cp$ line in the proportion $\frac{D_1}{D_2}$ or $\frac{D_1 p}{D_2 p}$. It is obvious that we could now scale $D_1 p$ and $D_2 p$ and so determine $D_1$ and $D_2$. However, the writer has found this method very unsatisfactory because the $2Cp$ line has an inaccurate intersection with the $x$ axis, and it is very difficult to make a line pass accurately through a point when the end point locations are not yet determined.

To overcome these inaccuracies, we first lay in the $2Cp$ line as correctly as possible and then strike an arc $AB$ from $O$ as center, the radius of which is $Cp$. This arc intersects the $2Cp$ line at $B$. From the geometry of the figure, it is clear that the arc should accurately bisect the $2Cp$ line, but if it does not the necessary correction can be easily made. This correction is most important and only in lucky cases would any scaling be good enough without this check.

Two precise intersections, $P$ and $B$, have now been determined and the distance between these two points can be scaled with great accuracy. The distance $PB$ is equal to $Cp - D_1 p$, hence

$$PB = p(C - D_1)$$

$$D_1 = C - \frac{PB}{p} \qquad (3)$$

$$D_2 = 2C - D_1 \qquad (4)$$

The diagram in Fig. 2 has been laid out for an actual case, in which $C = 5$ in., $p = 16$, and $\frac{N_1}{N_2} = 2.75$. The various combinations of tooth numbers giving a ratio of 2.75 to 1, are as follows:

| $N_1$ | $N_2$ |
|---|---|
| 88 | 32 |
| 77 | 28 |
| 66 | 24 |
| 55 | 20 |
| 44 | 16 |
| 33 | 12 |

Choosing a value of $N_1 = 66$ and $N_2 = 24$ and following the exact procedure as given above, it was found that distance $PB = 11.63$ at the scale used. Substituting this in equation 3,

$$D_1 = 5 - \frac{11.63}{16} = 4.274$$

$$D_2 = 10 - 4.274 = 5.726$$

These dimensions can be easily checked by modifying equations 1a and 2a as follows:

$$\frac{N_1}{pD_1} = \cos a$$

$$\frac{N_2}{pD_2} = \cos (90 - a) = \sin a$$

Inasmuch as $\cos^2 a + \sin^2 a = 1$, we can add the two equations and obtain

$$\frac{N_1^2}{D_1^2} + \frac{N_2^2}{D_2^2} = p^2$$

and the substitution of the numerical values gives

$$\frac{4356}{4.274^2} + \frac{576}{5.726^2} = 256$$

In this expression it will be noticed that the value $\frac{4356}{4.274^2}$ is by far the most influential and, therefore, if the equation is not identical at first, the expression $\frac{N_1^2}{D_1^2}$ only requires slight modification and the necessary correction for $D_2$ follows without check.

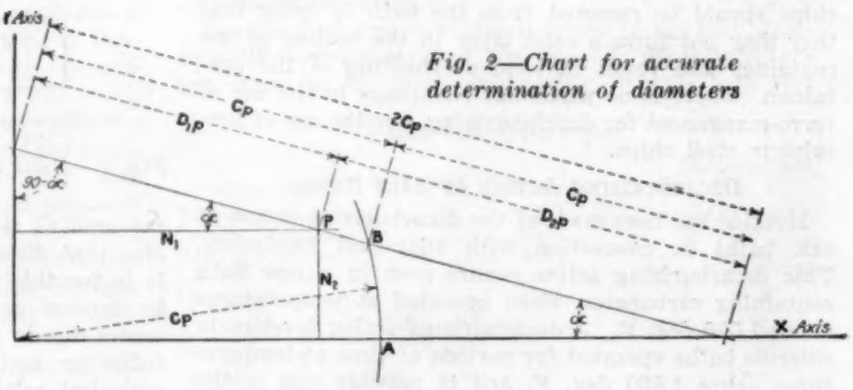



*Fig. 2—Chart for accurate determination of diameters*

# Locomotive Repairs in New Burlington-Denver Shops

By Howard Campbell
Western Editor, *American Machinist*

## Concluding article—Grinding operations—Saving time on cylinder drilling — Milling keyway in crosshead — Adjustable jacks for boring mill — Pit for heating tires

A MORTON railway shaper is shown in Fig. 10, set up to plane the radius and exhaust nozzle on a pair of cylinders. The ¾ in. of stock is removed in two cuts and the work is done in very quick time. The operation of planing the splice joint, center casting pad, upper and lower frame fits, smoke box radius and key fit is finished in what is considered as record time, although the amount of machining is reduced somewhat through the expedient of having bosses cast on the ends of the cylinders for the cylinder-head and valve-head joints.

Most of the cylindrical grinding is done on the Modern grinder shown in Fig. 11. The piece in process is a main crank pin that has been rough turned with $\frac{1}{64}$ in. of stock left for the grinder to take off. A 20x2½x5-in. wheel is used, running at a speed of 2,000 r.p.m. The piece is held to a tolerance of 0.003 inch.

Links are ground on the Sundstrand valve motion grinder shown in Fig. 12. The piece shown in the machine is a steel casting with approximately $\frac{1}{32}$ in. of stock to be removed, which is necessary in order to true up the radius. The machine is the first of a type developed by the engineers of the Rockford Milling Machine Co. and the Burlington R.R. working in conjunction. All grinding operations on valve motion are done on this machine, which is both rapid and accurate.

The illustration Fig. 13 shows how follower plates

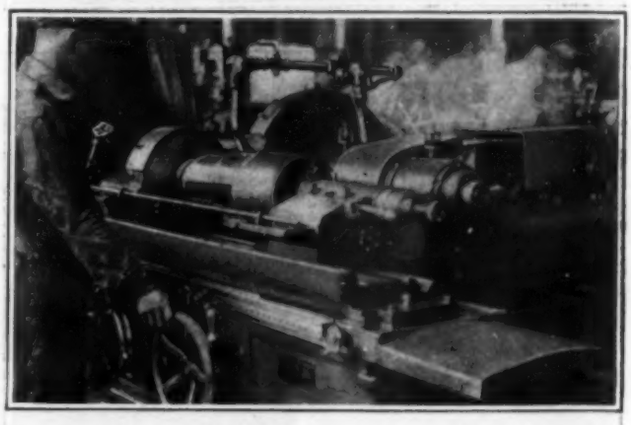


*Fig. 11—Grinding a main crank pin*

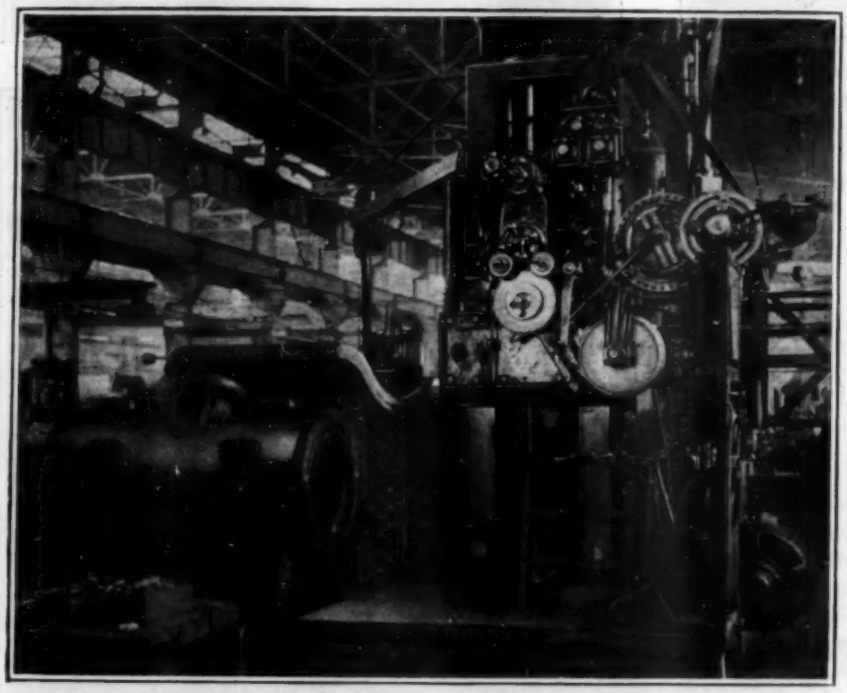
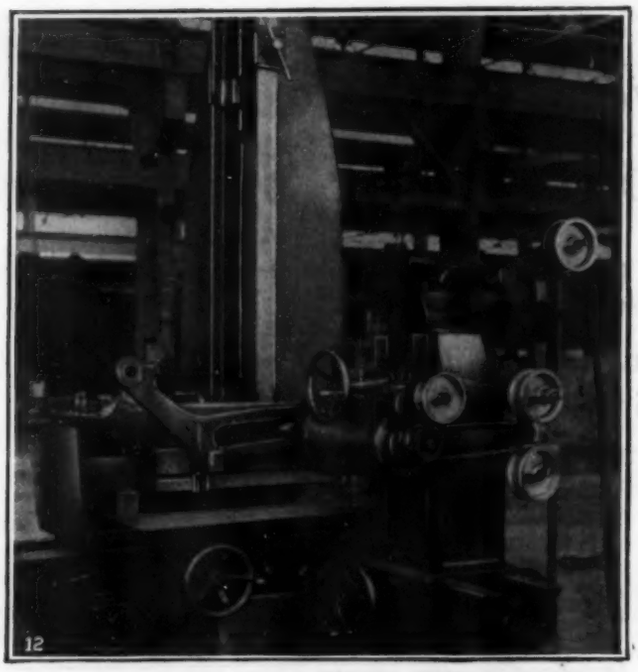


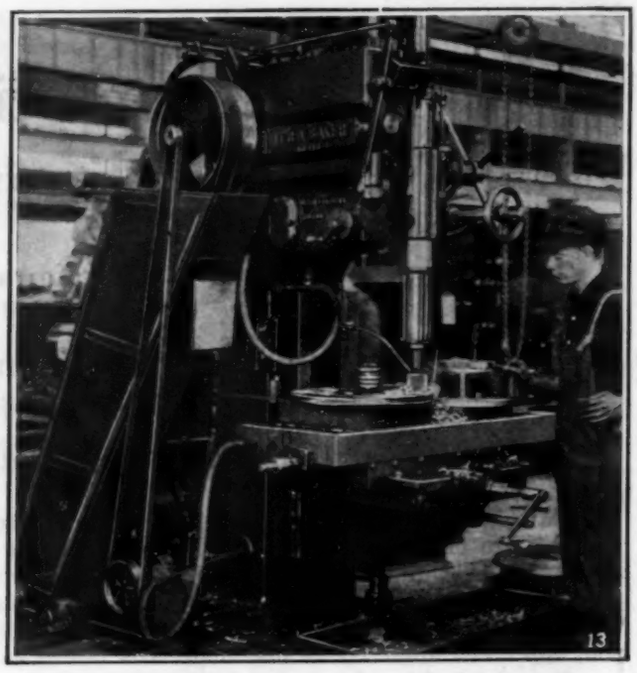
*Fig. 10—Planing radius on saddle*

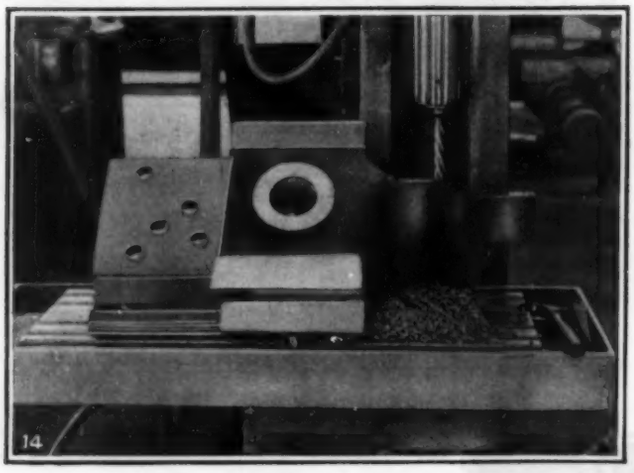
for pistons are counterbored. The machine is a Baker drill and the tool is a double-blade 3x$\frac{7}{16}$-in. counterbore, which is used in this instance to finish the hole to a depth of 1¼ inch.

Another job that is done on the same machine is that of drilling and cutting the keyways in crossheads, as shown in Fig. 14. The piece is held at the correct angle by being clamped to the face of an angle-plate jig. A $\frac{13}{32}$-in. hole is drilled in one end of the keyway layout, then a ¼-in. spiral cutter is inserted. The lower end of the cutter locates in a bushing in an arm that is attached to the column of the machine. Feeding the table by hand, the slot is milled lengthwise, after which the sides are trimmed to the finish dimension, which is $\frac{13}{16}$ inch.

A considerable amount of time can be saved on the operation of drilling, reaming, spot-facing and tapping the holes in the cylinder by finishing two pieces in the same set-up, as shown in Fig. 15. Much of the time that would







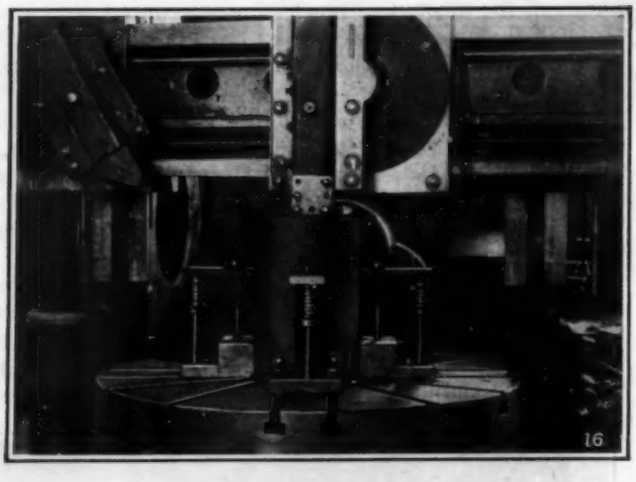


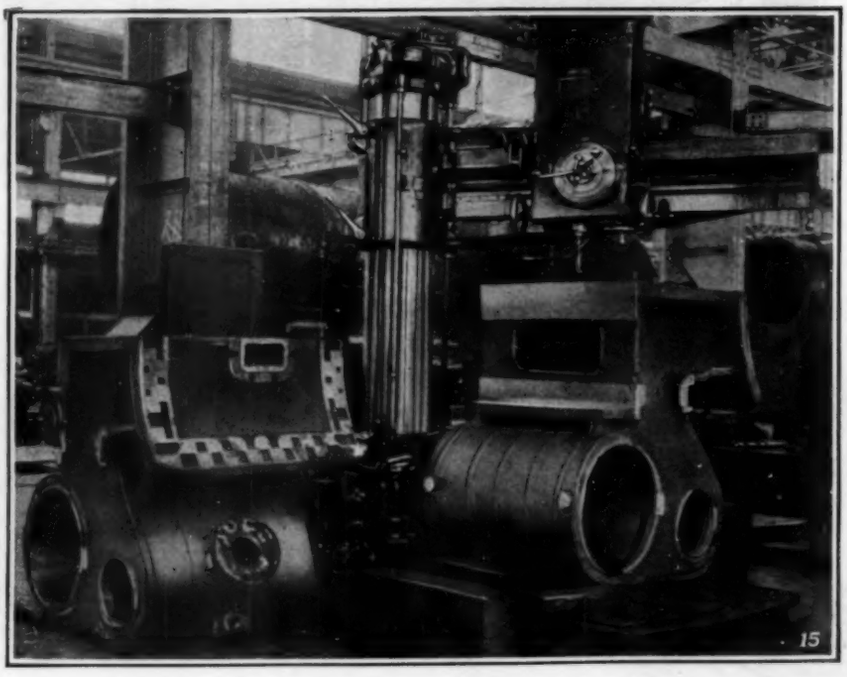
*Fig. 12 — Sundstrand valve motion grinder in action*

*Fig. 13—Counterboring holes in follower plates*

*Fig. 14—Milling keyway in crosshead*

*Fig. 15—Two cylinders are drilled in one set-up*

*Fig. 16—Note the adjustable jacks*



otherwise be spent in changing tools and raising and lowering the arm is saved and it does not take much longer for the crane to shift two castings than it would for one. Ninety-seven holes are drilled in each cylinder, of which 61 are tapped and 20 are spot-faced, and the flange is reamed for the ball-joint and turned with a box tool. The operation is completed in remarkably fast time.

The illustration Fig. 16 shows a valve bushing set up for boring on a Putnam boring mill. The interesting feature of this job lies in the jacks upon which the ends of the straps are supported. There are four jacks, each composed of three pieces as shown in Fig. 17. The part *A* is a section of steel tubing through which the part *B* passes, *B* being supported in place by the "horseshoe" *C*. By reversing the horseshoe, a variation in height of ⅜ in. can be obtained. The bushing is held in jaws that have been bored part way down on a radius corresponding to the diameter of the bushing, a shoulder being left which holds the bushing high enough off the table so that the chips can be removed

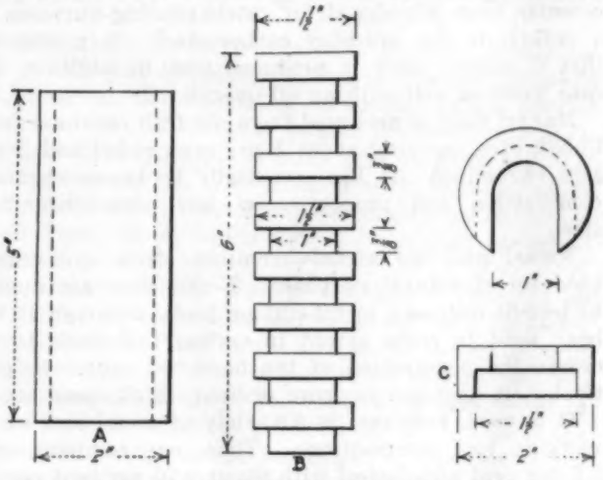



*Fig. 17—Details of adjustable jack*

and so that the tool will clear the work when it reaches the bottom of the cut.

Tires are expanded by heating in the DeRemen-Blatchford tire-heating furnace shown in Fig. 18. The pit is six ft. deep and is lined with fire-brick on the sides and bottom. Distillate is used for fuel. Twelve tires, which is the capacity of the furnace, can be

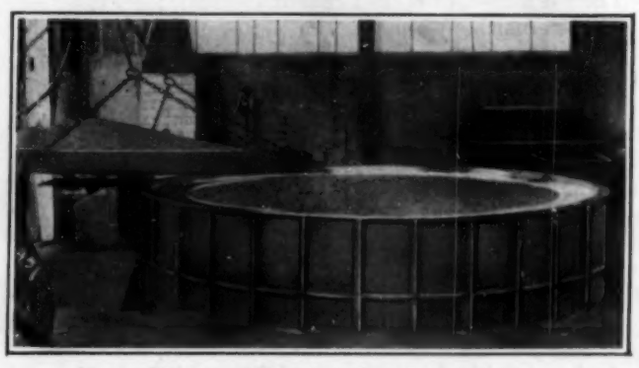


*Fig. 18—Tire-heating furnace*

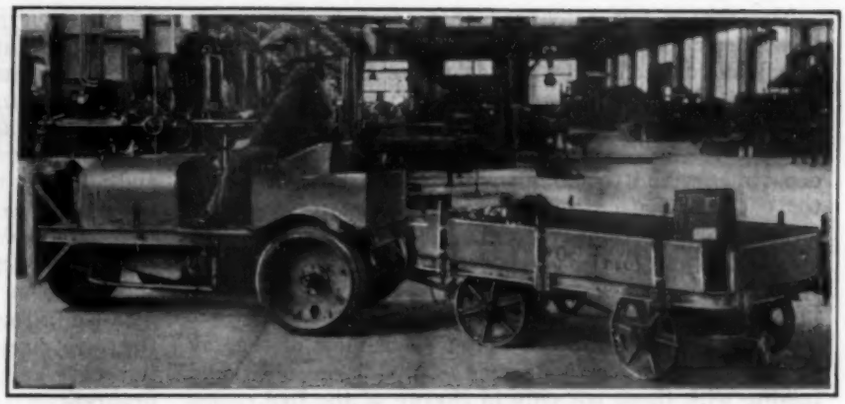


*Fig. 19—One man handles all materials*

heated to the desired temperature in 35 minutes.

Practically all the handling of materials between departments and from the store-room to the shop is taken care of with the Clark "Tructractor" shown in Fig. 19. Hand trucking in this shop has been eliminated entirely, resulting in considerable saving in both time and labor.

# Industrial Czechoslovakia

BY LILLIAN M. GILBRETH

THE most noteworthy thing about industrial Czechoslovakia is the spirit of the people. This is felt as soon as one enters the country. Every available spot is being cultivated assiduously and the crops are an attractive sight. But it is the look on the faces of the farmers as a train passes their fields, or as they gather at the station to see the foreigners who have come to the Congress that makes the most striking impression. There is industry and determination, but there is also interest and hope. It is the look of "the man who sings at his work," not because this is a part of the prescribed routine, but because he actually feels like singing.

To the engineers of the visiting party, this look is not so much of abstract sociological importance as of concrete value as an indication of labor conditions and of what our manufacturers must expect, in competition or co-operation.

It is perhaps not surprising to find a co-operative and enthusiastic aspect among the Czech engineers who gather from all parts of Czechoslovakia for the First International Management Congress. They are naturally interested in the subject of scientific management, and in the possibilities of its application to industrial problems in their country. But their unanimous agreement that industrial conditions there are satisfactory, their reports that all Czechoslovakia desires to work, and that there is work and a definite job for everyone, reflect a condition that is at this time almost unique.

## PLANT VISITATION

Readers of the *American Machinist* have already had outlined to them the program presented at the First International Management Congress and the boundless hospitality afforded. It is to be noted that not only were visits to plants included in the elaborate program, but also that every engineer, manufacturer or other representative of industry present pressed upon every delegate, opportunities to visit plants not already listed, at any time, in any manner and to any number preferred.

The writer felt convinced that most benefits from these visits to plants would be obtained by the Czechoslovakians as well as by the delegates from the United States if certain members of the party omitted, to some extent, the general survey trips through the plants and confined themselves to intensive observations of certain departments and to talking with the workers, in order to get information not only concerning working conditions but also concerning their personal reactions to these. Permission to carry out these plans was easily obtained, and every facility was afforded to make the investigations most successful.

At the Skoda Works the writer spent most of the day visiting the various tool rooms of that large plant and talking with those not only in charge of the tool rooms but with the workers, as they came to obtain or return tools. The tool rooms themselves were models of efficiency. All best practice in American industry had been carefully studied, and it was astonishing how much had been done by those who had been guided by our literature alone. Superstandardization and even advanced standardization had not yet been attained, but the enthusiastic co-operation of all those working in the tool room had been secured and maintained. The young Czech in charge had been careful to delegate authority and to functionalize the work, with the result that there was a personal pride in achievement which is certain to lead to results of lasting value. While the European idea that material is of paramount importance had led to what we should consider undue carefulness in handling and storing of tools at the expense of much time and labor, ease in securing tools and inspection and over-inspection had been carefully considered. It is not to be expected that the results would equal those in the most highly refined and systematized tool rooms on this side, but the desire to improve conditions, the interest and the willingness to work together cannot be excelled anywhere.

### Progressive Plants

The writer had the privilege of making a specially arranged trip to the shoe factory at Zlin, of inspecting the Baca plant thoroughly, of conferring with managers and workers alike, and of going through the splendid housing project now in course of construction. In this plant are not only the most modern of transportation devices and of waste eliminating and cost reducing equipment, that enable the manufacturers to compete with American manufacturers not only in Czechoslovakia and in Palestine but in Chicago, but also a friendly interchange of ideas and actual working together between employers and employees that can only be equalled by the Clothcraft Shop of Cleveland and others of the most progressive American plants.

The question of industrial housing has been most thoroughly considered throughout Czechoslovakia. In one town the mayor has devoted himself not only to administration but to town planning and to personal supervision of such industrial activities as the Tanners School. In a model village there are community activities, such as a bakery, a gymnasium, a theater, etc., which would be hard to find surpassed anywhere. Not only is the mayor of the town the leading spirit, but he has enlisted the loyal co-operation of the community to an extent that can only be realized after talking with the farmers, as well as looking at their model activities.

Add to these facts concerning labor conditions and the attitude of labor in Czechoslovakia, the interest in their problems of the Academy Masaryk and the interest of the government officials, and we have a most encouraging state of affairs.

The Academy not only has various committees which take up and investigate problems submitted by industry, but also is accustomed to calling the trades and the workers submitting the problems into actual conference, and allowing them to demonstrate, so far as is possible, their practice and their needs. Extended conferences with the various government officials and ministers in charge of activities that have to do with industry, showed them not only possessed of most thorough and detailed information concerning the work over which they are placed but anxious to impart information and to secure any suggestions that might lead to intelligent progress.

All this indicates that industry is in a most prosperous condition in Czechoslovakia; that labor is a constructive force in the community, and that industry in this country can afford to co-operate with Czechoslovakian industry in every way possible, not only to give but to secure information of value.

## Low Nickel Steels

According to circular No. 100 of the Bureau of Standards, the use of one-half per cent nickel-steel has recently been introduced for casehardening purposes as a substitute for ordinary carbon-steel. It is claimed that a tougher core is produced and, in addition, the case hardens well with an oil quench.

Mayari steel is produced from pig iron obtained from Cuban ores carrying about 1 per cent nickel and 2 per cent chromium. It has essentially the same chemical composition and properties as low nickel-chromium steel.

Nickel and the nickel-chromium steels are chiefly used for structural purposes. Nickel does not appear to benefit ordinary metal-cutting tools, although it has been used to some extent in carbon tool-steels to increase the penetration of the hardened zone. In particular, it does not improve ordinary high-speed steels.

It is used, however, in a variety of metal and woodworking tool compositions. Thus, one company uses 3.5 per cent nickel-steel with about 0.70 per cent carbon in band saws. Low nickel-chromium steel with from 0.60 to 0.70 per cent carbon is used for pneumatic chisel-steel, sledges, and hatchets, and is a favorite material for drop-forging dies.

## Nomenclature

By Sol Wright

The old names of tools I consider erratic;
They're neither euphonic nor yet systematic.
Miller and driller and planer and shaper
Do well in the shop but they look bad on paper.

They have not the power to make one ecstatic;
They're much too plebeian, not aristocratic.
They're close to the soil like the plow and the harrow;
They don't lift the soul; they are plain, they are narrow.

But now we have names which are definite, emphatic,
With some of the charm of equations quadratic.
Tero and Multo and Simpli and Roto
Duo and Neu and variations on Moto.

And one thing is sure, one might say it is static,
Namely that all must be ending in Matic.

# Automotive Production

## Machining Gears for an Electric-Truck Driving Mechanism

**By Fred H. Colvin**
Editor, *American Machinist*

Special tooling to undercut pinion for clearance for gear-shaper cutter—Fixture for hardening the bore—Overcoming distortion due to hardening a large internal gear

THE drive of the trucks built by the Commercial Truck Co., Philadelphia, Pa., is through planetary gearing, the machining of which involves several problems. One of the gear blanks is shown in Fig. 1, where the first operation is being performed on a Potter & Johnston machine. The blank is made from bar stock in the usual way, except for the undercutting as shown on the blank at *A*, which has had the first operation completed.

The undercutting is done by the tool *B* mounted on the front of the cross-slide and controlled by a cam-slide shown in Fig. 2. This figure also shows the blank at *A* and the tool at *B*. The holder which carries the tool swings from the pivot *C*, the controlling cam being in the block *D*. A tongue or guide on the lower side of the toolblock gives the actual movement to the tool itself. The camblock *D* is supported by the frame *E*, so that the cross slide and the toolblock can move while the cam remains stationary. Under the guidance of this cam, the tool *B* feeds into the face of the blank to the proper depth, and then forward until there is a sufficient undercut to allow clearance for the gear-shaper cutter. This method is the outcome of considerable study on this particular job, and has proved very satisfactory, both as to the product and the time required.

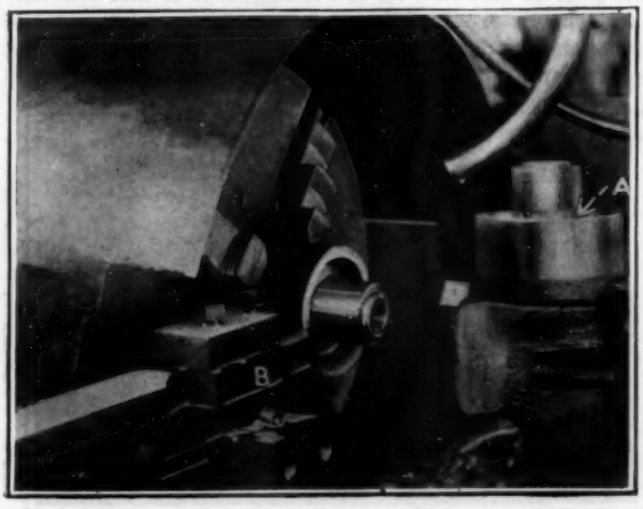



*Fig. 1—Undercutting for pinion teeth*

The outside turning tool is shown at *F*, Fig. 2, the work being supported by the pilot *G* while the outside

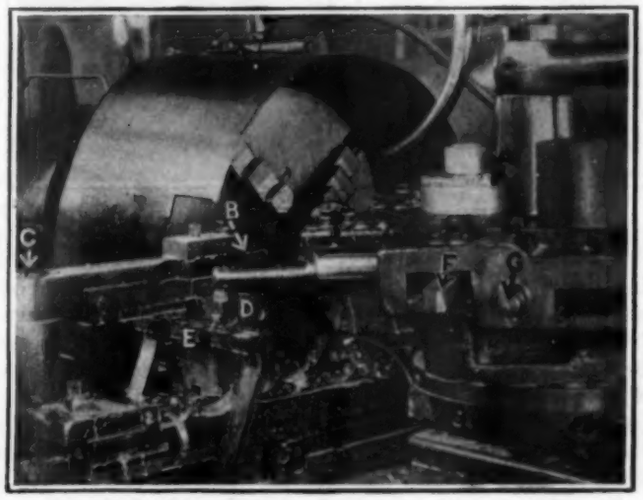



*Fig. 2—Details of tools used*

is being turned. After the blank is cut off, the turned portion is gripped in smooth jaws and the second side finished, as shown in Fig. 3. This operation requires very little special tooling, as the blank is simply faced and counterbored without the undercut necessary on the other end. The succeeding operations finish turn and cut the teeth on the two diameters, after which the gear is ready for heat treating and the hardening of the hole.

A very simple fixture takes care of the hardening operation, the only problem being to get a hard surface in the hole by cooling the bore quickly without quench-

# AUTOMOTIVE PRODUCTION

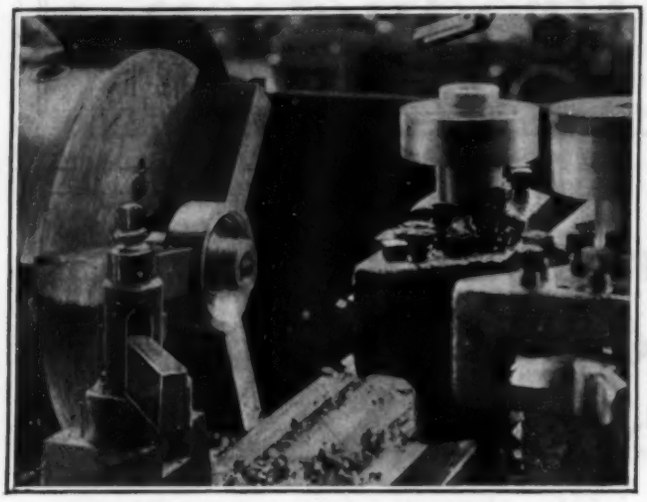


*Fig. 3—Finishing the second side*

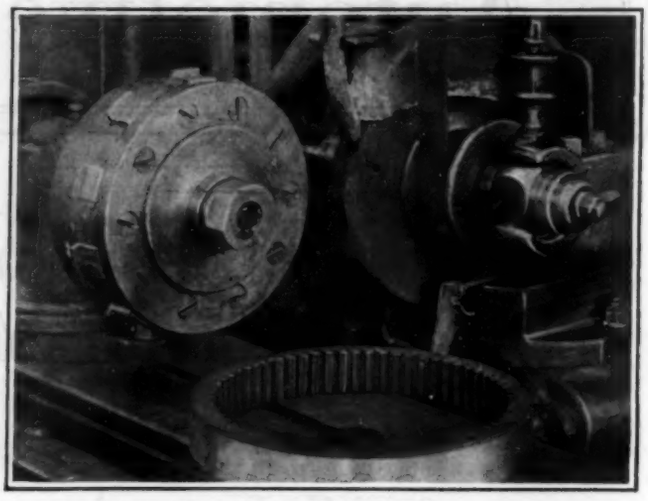
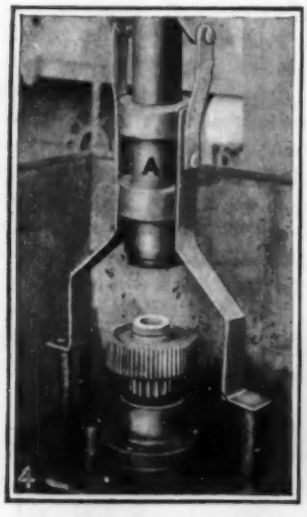
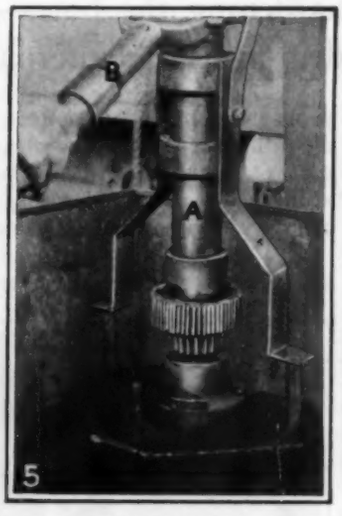
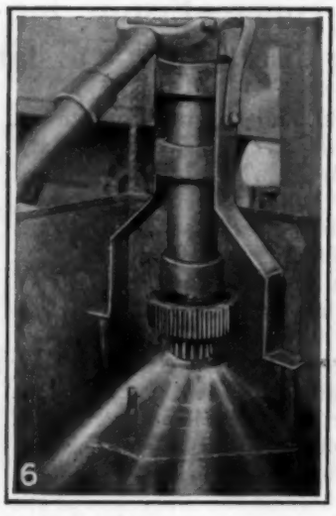


*Fig. 8—Chuck for removing distortion*



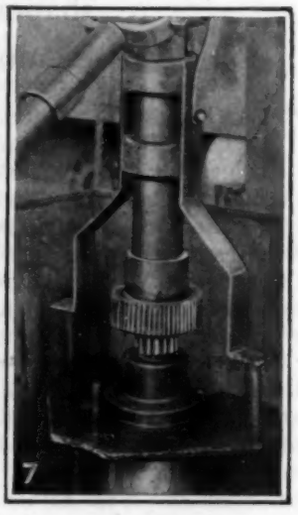




*Fig. 4—Fixture for hardening hole. Fig. 5—Gear held in position. Fig. 6—Before heat chars wood. Fig. 7—After the joint is made*

ing the whole gear at once. This is done in the fixture shown in Figs. 4, 5, 6 and 7. After heating, the gear is placed in the position shown in Fig. 4, and then brought up against the lower end of the hollow plunger *A*, as shown in Fig. 5. The cradle holding the gear is controlled by the lever *B*, which forces it up, holding the gear in place while water flows through both the plunger and gear and out into the tank beneath.

In order to make the seal at each end of the gear, hollow wooden plugs are used, these being placed so that the end grain of the wood comes against the hot gear. The heat chars the wood sufficiently to form a water-tight joint and allow the stream of cold water to flow through the hole in the gear as long as is necessary to cool it to the desired temperature. Fig. 6 shows how the water sprays around the end of the gear until the seal has been formed, after which, as shown in Fig. 7, the water flows straight through.

A very practical method has been devised for correcting distortion in the large internal gears after they have been hardened. The blank is carefully machined, special attention being paid to the inside, which after cutting becomes the top of the gear teeth. The gear blank is set from this surface and the teeth cut so that they will be concentric with it. After heat treatment, the gear is mounted on the chuck, Fig. 8, and the ten jaws shown are forced out by an internal cone until the spring or distortion has been removed and all of the jaws bear on the inner ends of the teeth. The outside

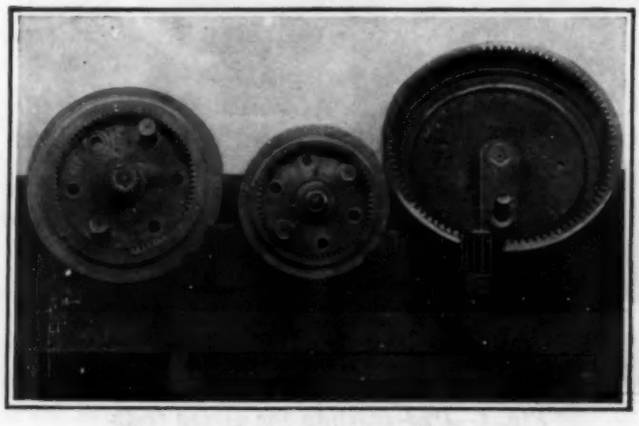


*Fig. 10—Testing fixtures for gears*

# AUTOMOTIVE PRODUCTION

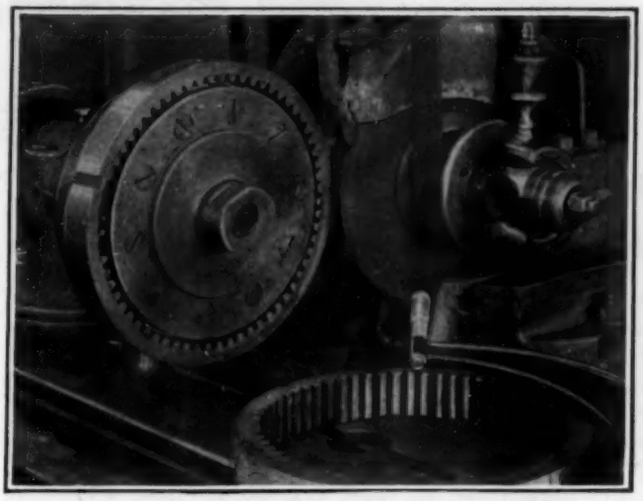


*Fig. 9—Grinding ring gear*

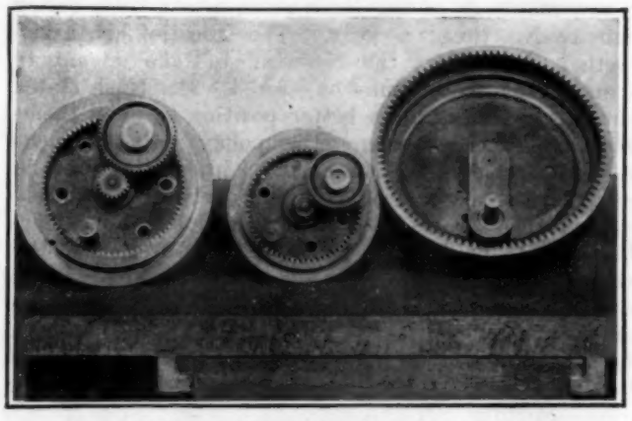


*Fig. 11—Gears in place for test*

of the ring is then ground to the proper size to give a press fit in the case or carrier in which it is mounted. Then, although the internal gear springs to some extent when it is removed from the chuck, it is again forced into its correct shape on being pressed into its case. In Fig. 9 the gear is shown mounted on the chuck.

In order to make sure that the gears mesh properly and run smoothly, they are carefully tested on the fixtures shown in Figs. 10 and 11. Fig. 10 shows a master internal-gear and a master driving-gear in position, while in Fig. 11 the intermediate gears have been placed on their studs, so that the accuracy can be tested at all points.

Standardization is today the most important approach to greater industrial efficiency. According to *Standardization*, a booklet published by the American Engineering Standards Committee, the magnitude of the yearly savings to be made is almost incredible; they are to be measured, as Secretary Hoover has said, "in hundreds of millions and billions of dollars." Actual savings that are now being made in the automobile industry through organized standardization activities are estimated by the industry itself at seven hundred and fifty million dollars a year; it is these savings which have made the automobile generally available, instead of its being only a luxury for the rich.

# Abstracts

## *from other publications*

### Complete Gaging System

The system of inspection at the General Motors Truck plant at Pontiac is described somewhat briefly. Dimensional gages are provided for each part. Snap and plug gages of the go and no-go variety are used for detail dimensions. Dial indicating gages and master gages check the relationship of different surfaces and finally functional gages that define all of the essential dimensional requirements of the piece in actual service are utilized for final inspection. All of these gages are checked constantly by the most improved equipment that is kept in the gage checking room.

Johanssen gage blocks, master thread gages, match surface plates, taper gages, optical, and other types of accurate measuring devices are typical of the equipment of this department. Gages in use are issued upon checks that serve as guides for the gage checkers.

For the large diameter at the tapered end and the diameter of the splined end before that operation is performed, adjustable snap gages are used. Hardened and ground ring gages, go and no-go, check the completed splined end and snap gages check the depth at the bottom of the splines and the width across each individual spline. A slip ring gage is used on the taper and an adjustable thread gage on the thread at the outer end. The width of the keyway is checked by a plug gage and the parallelism of the bottom of the keyway with the adjacent surface of the tapered end is checked by a snap gage.

In one of the operations in machining this shaft, inspection gages are mounted on the arm of the machine boring on the work itself, so that the work can be checked for accuracy in operation. Similar descriptions are given of other gages for clutches, frame assembly, etc.—*Automotive Industries*, Sept. 11, p. 472.

### Automatic Painting Equipment

Automobile frames are cleaned, painted and dried and delivered in a continuous stream to a car door ready for loading at the rate of ten a minute by means of a new painting and conveying unit recently placed in operation for handling frames for Ford cars. This installation has resulted in a 50 per cent saving in labor.

In connection with this unit a progressive assembling line 175 ft. long is provided for assembling the various parts of the passenger car frames. Side sections are formed on presses located below the start of this line. Various small parts are delivered from forming presses through two gravity chutes on the assembly line. Following the plan generally used in the assembly of an automobile chassis the parts are delivered to the line at points near where they are to be placed on the frames. The frame assembly work is limited to various riveting operations which are done on 22 horning and wiring presses located 6 ft. to 10 ft. apart. Back of the presses is an assembly table of heavy plate construction 9 ft. wide and 3 ft. high.

# AUTOMOTIVE PRODUCTION

The frame, which lies flat and lengthways on the cleaning and painting conveyor, is first given a rinsing bath in a strong caustic solution, and is then washed in clear water at boiling temperature. The conveyor passes over tanks one containing the water and the other the solution. The water and caustic solution are heated by live steam from the boiler house and are forced over the frame by two centrifugal high pressure pumps through 48 nozzles connected to each pump giving a water pressure of 35 lb. per square inch.

The drying oven is heated by two seven-section McCann-Harrison direct oil-fired heaters provided with a standard fuel control system for uniform temperature, the control being by means of an air gage. Consequently thermostatic control is unnecessary. Hot air is forced through the tubes of the heaters with a capacity of 14,000 cu.ft. of air per minute and the temperature of the oven at its entrance is about 110 deg. F. This gradually increases to 200 deg. at the hot zone. At the discharging end it falls to about 120 deg. The heat in the frame aids in baking the enamel during the movement of the frames through the lower end of the oven after they have passed the hot zone. The conveyors have handled 620 frames in one hour and a record has been established of 5,380 frames in 9 hours.—*Iron Age*, Sept. 4, p. 555.

## Heavy Duty Drilling and Boring

Herbert L. Tigges of Baker Bros., Toledo, Ohio, contributes an illustrated article dealing with automotive production methods in which he states that on handling automobile cylinder blocks, boring on vertical multiple-spindle machines is common practice when high production is required, but if the production is small, a single spindle machine is more economical.

A cylinder block in which the four bores are completely finished on four-spindle cylinder boring machines is shown by illustration. Three cuts are taken in each bore, the block being first rough-bored to 3.605 in. in diameter. The actual cutting time for the first roughing operation is slightly more than two minutes and one operator handles two machines. The cutterhead used is of a special type with four blades set at a right-hand spiral. For the first rough boring step, the speed of the machines spindle is 60 r.p.m., the feed 0.060 in. per revolution, and the average production, forty-five blocks per hour. The straight-boring, reaming, and counterboring are all performed on one machine, the tools being changed each time.

Two machines are used for the rough boring operation and seven machines for the straight boring, reaming, and counter-boring. The block weighs 120 lb.

The four bores were reamed under a four spindle machine. This practice is followed in some plants, but in other plants it has been found desirable to ream one bore at a time on a single spindle machine.

There is a growing tendency to lap the bores in multiple for the final finish, and in connection with this operation a single-spindle heavy-duty drilling and boring machine is used for the reaming operation. The machine is often arranged with special gearing to give speeds of from 40 to 60 ft. per minute and feeds ranging from 0.0625 to 0.3125 in. per revolution.

Other examples given in this article are of cast iron piston and crankshaft forgings in which the flanges are drilled and reamed on the one machine. Finally there is a malleable iron spring seat. These pieces are detailed fully just as was the cylinder block.—*Machinery*, Sept., p. 46.

## Idle Raw Materials Earn No Dividends

This article by C. W. Nash, president of the Nash Motors Co., is well worth studying, not only by those in the automobile industry, but by any manufacturer. Mr. Nash deals largely with the problem of scheduling orders through plants so that they will all come to the shipping platform in finished shape at about the same time without any great amount of storing being done. He states that it is not easy to buy materials on the basis of requirements in the automobile industry, but at present he contracts for 5,000 or 10,000 units of a material, some definite quantity, and calls for delivery whenever he wants it. He turns the stock of raw materials at the Nash plant now a little better than twelve times a year. The question is asked whether this allows the company to take advantage of any bargains that may be offered. Mr. Nash states that this places them in better position to avail themselves of bargains than any other policy. His statement on the purchasing of material is interesting but he feels there is a world of difference between the buyer who appreciates the aspect of his job, who understands and applies this policy of turn-over, and the other kind of buyer who has his nose to the ground to find something cheap and loading up simply because it is cheap. Mr. Nash would rather have a 30-day supply of raw material bought at a fair price than a 12-month supply bought at a so-called bargain price.—*Factory*, Sept., p. 329.

## The Drill Press for Auto Repair Work

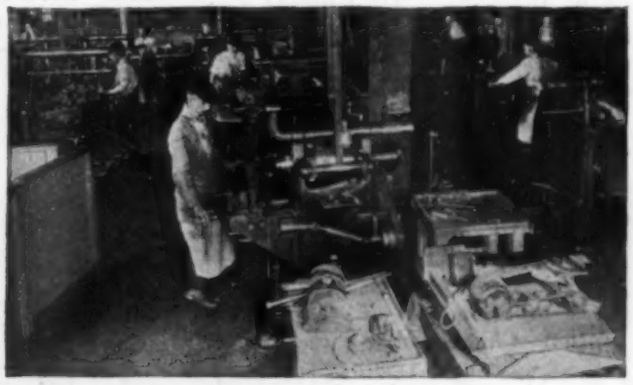
Next to the lathe the upright drill press is probably the most useful piece of equipment in the automotive shop doing all-around work. It is a multiple purpose tool and it is almost impossible to state fully the operations for which the drilling machine can be used. An investigation made by B. M. Ikert author of this article, would indicate that the 20-in. back-geared press with a power feed is the best buy. The 20-in. size means that the press will drill a hole in the center of a 20-in. circle and it is also capable of drilling one as large as 1¼ in. diameter in machinery steel. It is possible, however, to do boring jobs of a much larger diameter because a boring tool takes a much lighter cut. In buying a drill press it pays to get a large enough one because any holes of small diameter can easily be handled in an electric drill especially when the latter is fitted with a bench stand. The reason for this is that the automotive repair shop is often called upon to do emergency jobs outside of the automotive line, such as repairs on farm machinery, etc. On the 20-in. press, almost any kind of boring job can be handled. It is possible to broaden the scope of the drill press with a milling adjustment as such allows of a fed in two directions and an almost endless variety of work can be done by using proper cutters.—*Motor Age*, Sept., p. 14.

# *Where Machine Tools Are Made*

**The Steel Products Engineering Company**

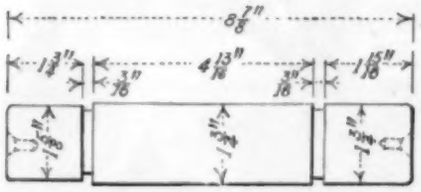
**Springfield, Ohio**

Established 1908

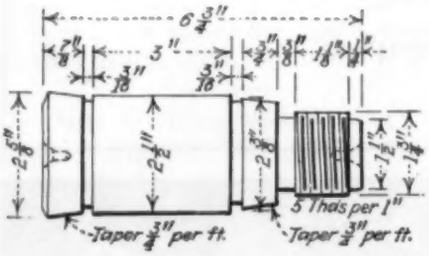


# What Modern Machine Tools Are Doing

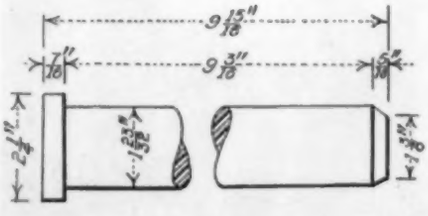
## *Cincinnati Acme Turret Lathes*



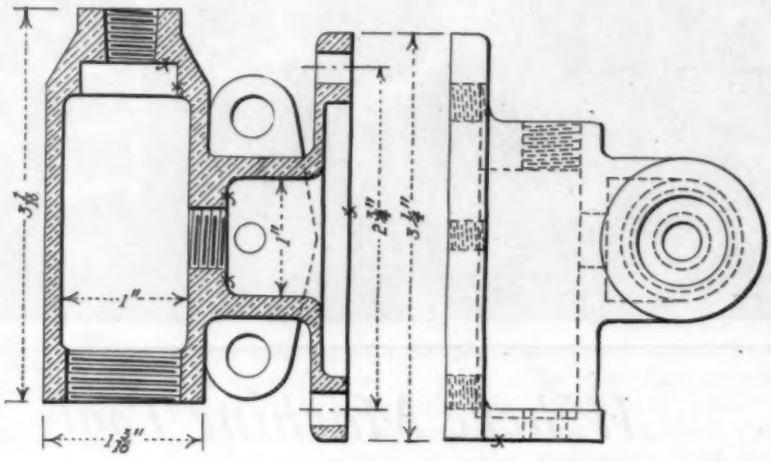
*Valve-rod pin. Geared-head flat-turret lathe. First operation — Chuck. First station—Turn 1⅝ in. diameter. Second station—Turn 1¾ in. diameter. Third station—Center. Sixth station—Neck and cut off. Second operation — center. Time 8 minutes*



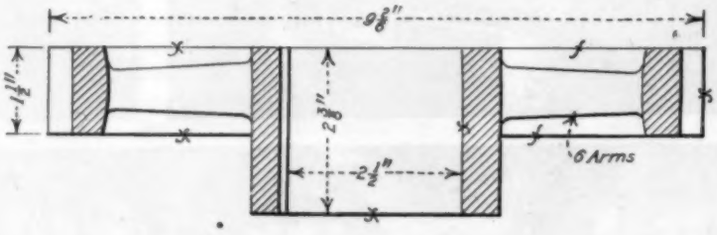

*Eccentric-rod pin. Geared-head flat-turret lathe. First operation—Chuck. First station—Turn 1¾ in. diameter. Second station—Turn 2½ in. diameter. Third station—Center. Fourth station—Chamfer. Fifth station—Thread, two cuts. Sixth station—Neck, taper and cut off. Second operation—Chuck, chamfer and center. Time, 11½ minutes*



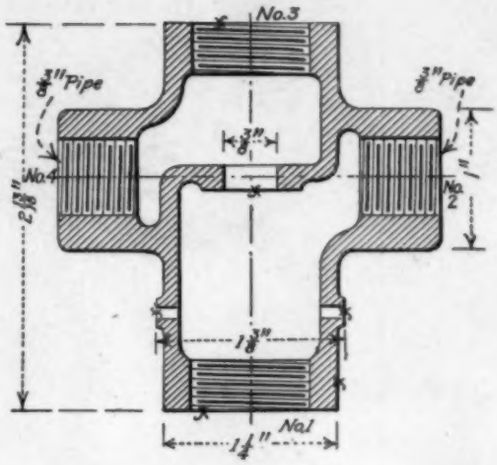
*Brake-hanger pin. 2½-in. rough stock. Geared-head flat-turret lathe. First station — Chuck to stop. Second station—Turn 1¹³⁄₁₆ in. diameter. Third station—Bevel. Fourth station—Cut off. Time, 13 minutes*



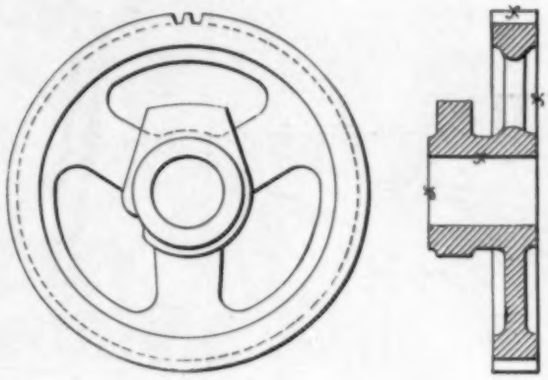
*Body. Brass. 16-in. plain-head turret lathe. Hold in revolving jaw chuck with special jaws. Face flange with facing tool held in tool post. Bore and face seat in flange end with combination boring and facing tool held in turret. Tap ⅞-in. thread. Index chuck—Bore ¾ in. and ⅞ in. diameters and face end with combination boring and facing tool held in turret. Tap ⅞-in. thread. Index chuck—Bore for ⅛-in. pipe tap. Tap ⅛-in. pipe thread. Time, 3½ minutes*



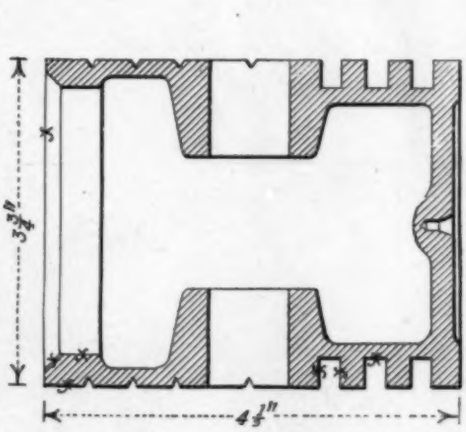

*Back gear. Semi-steel. 2½x26-in. flat-turret lathe with chucking equipment. Hold in 3-jaw chuck. Rough turn O.D. and rough back-face of gear. Rough straight side with two tools held in tool block. Rough bore and rough back-face of hub. Finish bore and finish back-face of hub. Finish face straight side with two tools in tool block. After facing insert reamer in 1½-in. hole (in same holder) and ream. Finish turn O.D. and finish back face of gear. Time, 12 minutes*



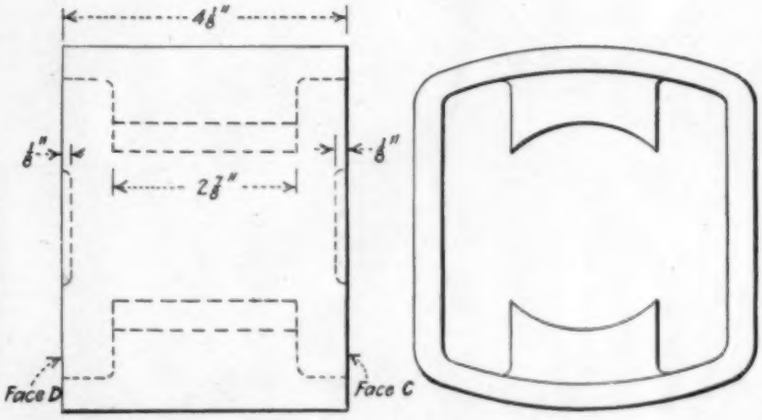

*Starting valve body. Steam metal. 16-in. plain-head turret lathe. Hold in revolving-jaw chuck with special jaws. Face No. 1—Drill ⅜ in. hole, face seat, bore for thread and face end with combination drilling, boring and facing tool held in turret. Turn 1¼ in. and 1⅜ in. diameters with box tool in turret. Tap. Bore for ⅜-in. pipe tap. Face No. 2—Tap. Face seat and bore and face for tap. Face No. 3—Tap. Bore for ⅜-in. pipe tap. Face No. 4—Tap. Time, 3 minutes*



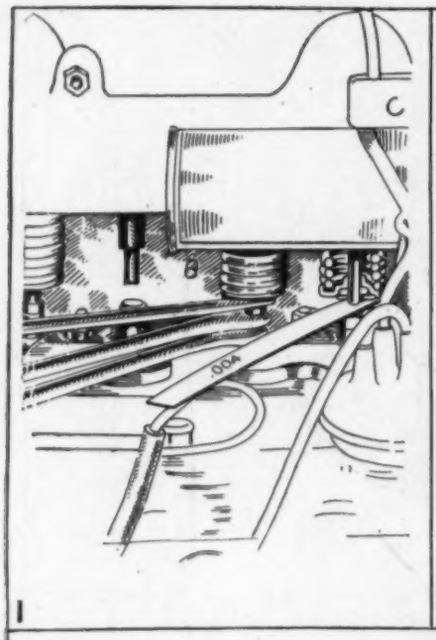
*Cam and Gear. Cast iron. 16-in. geared-head turret lathe. First operation—Hold in 3-jaw universal chuck. Rough bore. Face with tool in tool post. Finish bore. Ream. Second operation—Hold on special adapter fitted with driver. Turn O.D. with box tool bolted to turret and face side of gear with tool in tool-post at same time. Time, 10 minutes*




*Piston. Cast iron. 18-in. turret lathe with geared head and automatic chuck. First operation—Hold in 3-jaw chuck. Bore and face. Second operation—Hold in special piston-chuck. Rough turn with tool bolted against turret. Rough grooves with block on cut-off while turning. Finish turn and center with tool bolted against turret. Finish grooves with block on rear of cut-off while finish turning. Time, 12 minutes*




*Dynamo Yoke. Malleable iron. 2½x26-in. flat-turret lathe. First operation—Hold in 4-jaw chuck. Rough bore 3⅞ in. diameter, face (face C). Recess 5 in. diameter with special piloted boring-bar fitted with facing block. Finish bore, face, and recess with opposite end of bar. Size 5 in. diameter with single-point tool. Second operation—Strap on face plate, face (face D) and recess 5 in. diameter. Size 5 in. diameter with single point tool. Time, 10 minutes*

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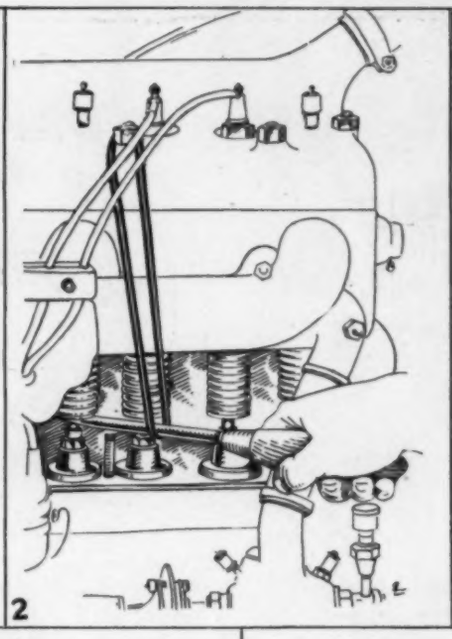

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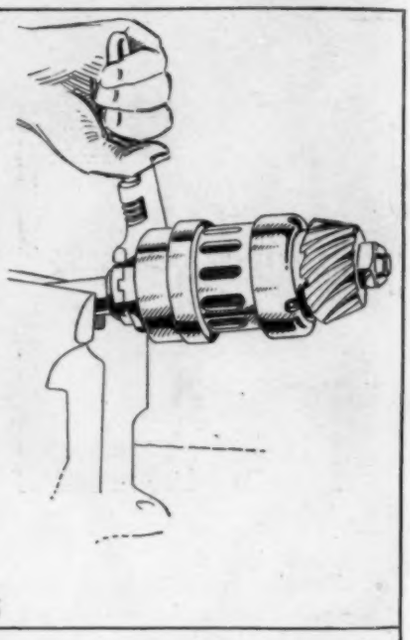

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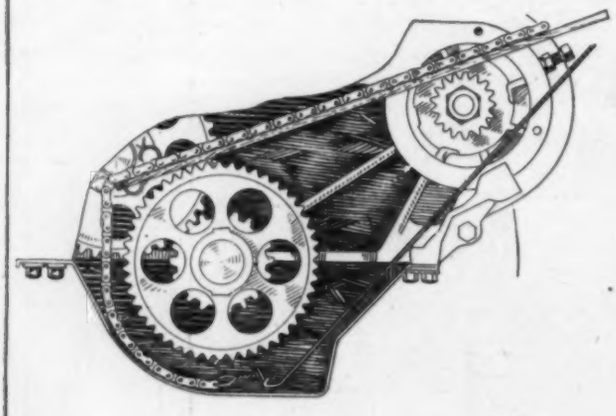


4

## Suggestions for Dodge Service Stations

Fig. 1—Adjusting valves to 0.004 in. clearance

Fig. 2—Easy way to compress valve spring

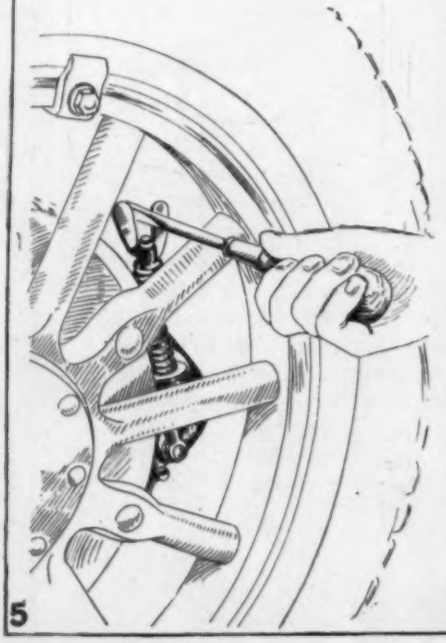
Fig. 3—Adjusting propeller-shaft bearings

Fig. 4—Putting in starter chain

Fig. 5—Adjusting upper half of outer brake

Fig. 6—Adjusting lower half of outer brake

Fig. 7—Adjusting rear axle-shaft bearings



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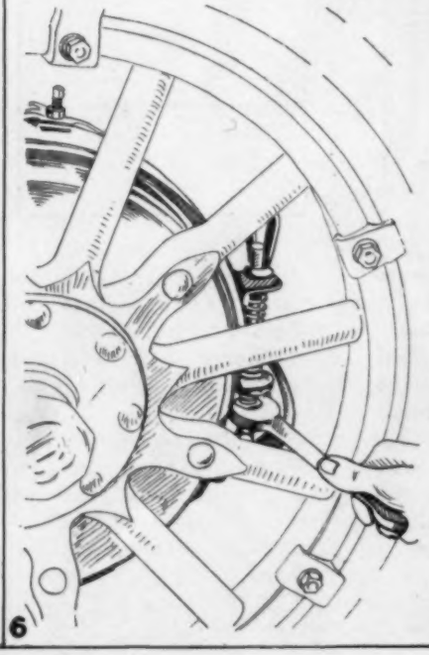

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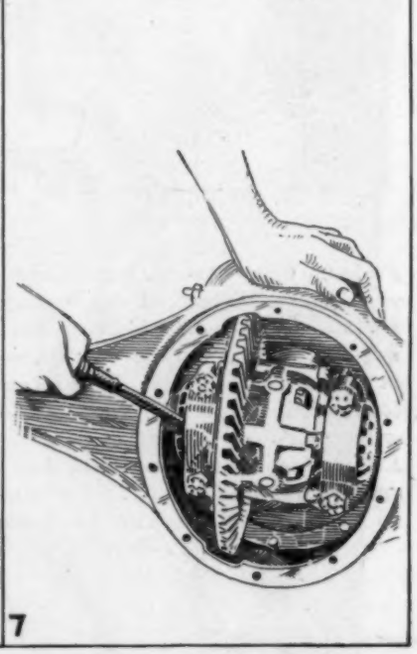


7

# Manufacturing the Right Line Radial Drill

**By John Haydock**

Maag and Gleason machines used for cutting gears—Scraping reduced to a minimum by careful planing—Main and sub-assembly of drills in lots of twenty

PARTICULAR attention has been paid to the gearing. The driving bevel gears mounted in the head are forged from a chrome nickel steel bar by the use of very simple forging dies and a Bement 2,000-lb. steam hammer, Fig. 11. After the blanks have been turned the teeth are cut on a Gleason bevel gear generator, Fig. 12, and run on a testing machine. This is done to insure a correct bearing on the teeth and quiet running of the gears. After the keyways are cut the gears are heat treated. The bores are ground on a Heald internal grinder by holding the gears in a special chuck which locates them from the pitch line of the teeth.

All the gears except the bevels are generated according to the Maag system. This system employs a rack shaped cutter ground all over, across which the blank is rolled, Fig. 13. The cutter operates with a vertical motion and between strokes the blank is revolved and moved forward a trifle forming a true involute tooth profile.

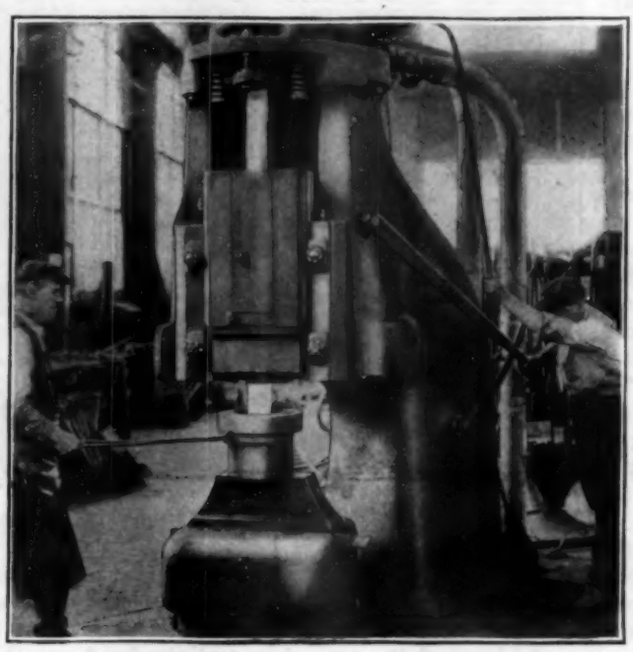


*Fig. 11—Forging gears in a Bement hammer*

The preparation of the gear blanks depends of course upon their size but in general the smaller blanks are turned from the bar on a Warner & Swasey turret lathe. Blanks from 4½ in. to 7½ in. in diameter are turned in a Libby turret lathe and larger sizes are cut off and chucked in a Pond rigid turret lathe. The same procedure is followed with other steel parts such as collars, washers, etc., wherever their shape and size permits. Instead of rechucking straight sided blanks for the smaller gears, it has been found more economical to face the side cut off the bar on a Pratt & Whitney vertical surface grinder using a revolving chuck. This gives an excellent finish in less time than putting them back on the lathe and makes the faces parallel so that they may readily be stacked in gear cutting.

Keyways are cut in a broaching machine whenever the size of the blank permits. This has been found to give good results especially when large numbers of blanks are machined. The feed gears have a four-splined hole which is handled in one pass by means of a special broach.

All bearings are bronze bushed except where roller or ball bearings are used. Under two inches these are turned from a bronze bar in a Pratt & Whitney turret lathe. Above this size bushings are cast in tubes from two to three feet long and machined in a Warner & Swasey turret lathe. In this way several bushings may be bored and turned in one cut before cutting them off the bar or tube.

The spindle sleeves are of chrome nickel steel which is heat treated in the rough. The bars are cut off and rough bored after which they are given an oil heat treatment which greatly increases their strength and wearing qualities but leaves them machineable. After heat treatment they are finish bored and bushings pressed in the ends. They are ground on plugs fitting these bushings and the rack teeth milled using a gang of eight cutters. The spindles are made of 0.60 carbon steel turned in a LeBlond 19-in. heavy duty engine lathe including the tapered hole for receiving the tool shank. The threads for the thrust washers are machined in a Pratt & Whitney thread miller, while the tang and key slots are milled and chamfered in a P. & W. 4-in. spline milling machine. After grinding the spindles are ready for assembly.

The machining on the Right Line drills is carefully controlled to reduce scraping and fitting to a minimum but due to the nature of the castings, a certain amount is necessary before the machines can be erected. The chief scraping operations are on the arm, column and head. The arm is scraped directly on the columns by means of an arrangement shown in Fig. 14, which pulls it forward and backward by a horizontal shaft driven

Concluded from P. 498, Vol. 61, No. 13.

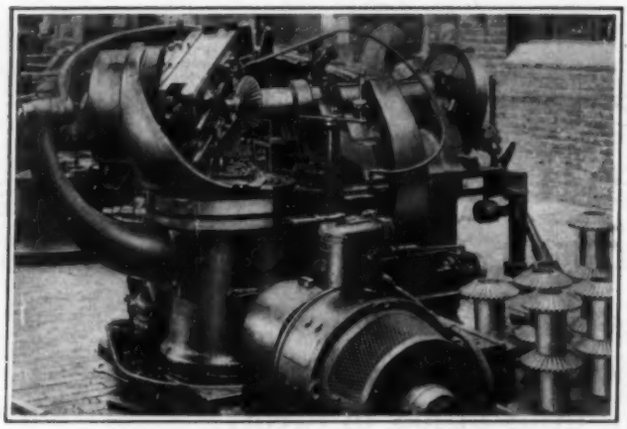


*Fig. 12—Generating bevel gears*

by an electric motor through a worm and wheel reduction and a rack and pinion. This unit is mounted on a small car so it may be used for a number of scraping operations without moving the castings. A simple clamping device is used for supporting the column. This arrangement eliminates the labor which is usually necessary in "pulling" large castings. The bearing surfaces are coated with red lead and scraped until a good bearing is obtained.

The head and the bearing surfaces on the arm which receive the head are scraped to templates. The template for the heads is simply an arm casting, the surfaces of which have been accurately planed. The heads are pulled along this using the same apparatus previously described until a good bearing is obtained. The arms are scraped to a shoe which is planed to the same angles as the portion of the head which bears on the arm. The arm is coated with red lead and scraped to a good bearing with this template.

The assembly operations on the Right Line drill are divided into two classes, the sub-assembly and the machine erecting. Units such as the head, speed box and motor drive clamp are built up on the sub-assembly floor. They are usually built in lots of about twenty, this being found the most economical number to put through at one time. The smaller parts including collars, gears, special screws, pins, etc., are manufactured in larger quantities and are used as required from stock. The heads and speed boxes are reamed in their boring jigs after the bronze bushings have been pressed in to insure accurate alignment of all the shafts. The fitting of the parts is carried on with great care. Each head is given a running test before it leaves the sub-assembly department to make certain that everything is perfect before it is delivered to the erecting floor.

The erecting is also carried through in quantity, a number of drills being built at one time, Fig. 15. The general procedure in building these machines is to lay out the bases, locating the ball and roller bearings for supporting the column. The columns are laid horizontally on wooden horses and the pedestals and the portion of the clamping mechanism inside the pedestal fitted to them. The column and pedestal are then picked up together, placed on the base and bolted to it. The arm is carefully located between the halves of the split column and the elevating screw put in place. The speed box and the head are then mounted on the back and front of the arm respectively. The arm shaft is passed through the bearing in the head and located in the coupling in the speed box. The external portion of the clamping mechanism is bolted in place and the clamp properly adjusted. The rollers supporting the head on the arm are adjusted to insure free traversing. The main driving and clamping motors are mounted in place and wired, making the machine ready to run.

Each machine is given a final thorough inspection before shipment. This covers finish, workmanship, adjustments, clearances, alignments and all

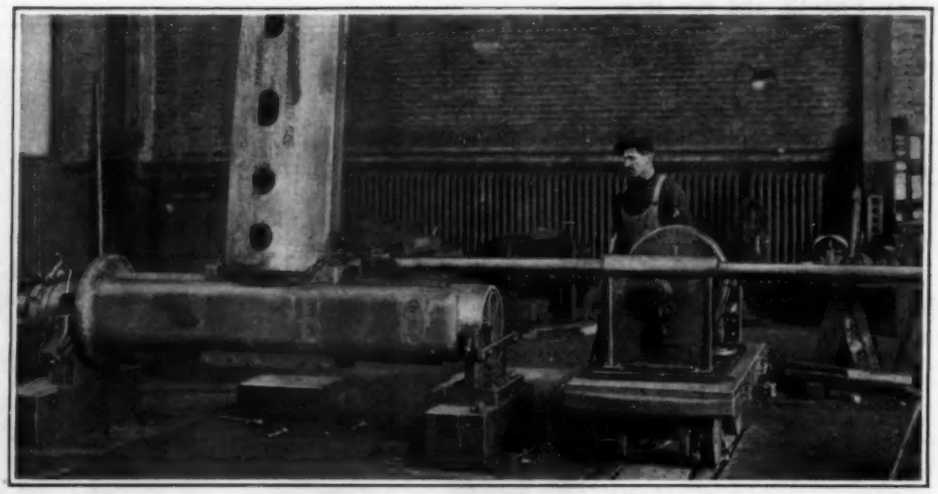


*Fig. 14—Scraping arms to the columns*

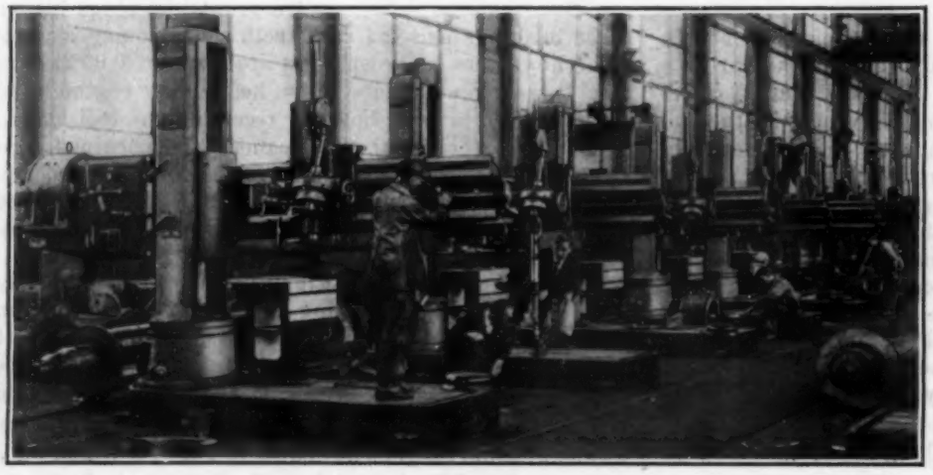


*Fig. 15—Erecting Right Line radials*

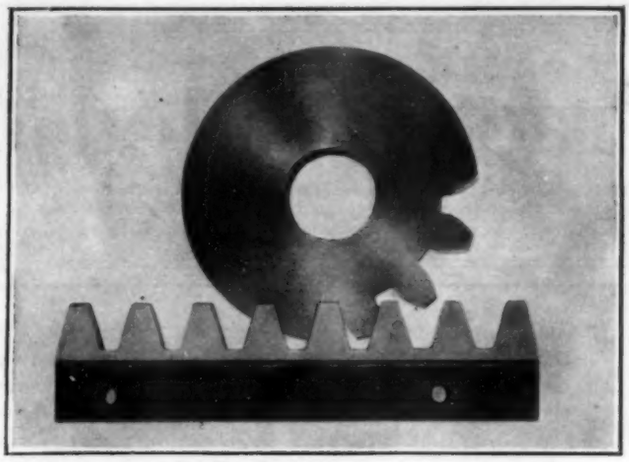


*Fig. 13—Method of generating Maag gears*

the operating features of the drill. In addition to this a work test is made on each machine during which it is loaded to the full capacity of the driving motor. In this way it is assured that each machine is perfect not only as to appearance and measurements but also under actual operating conditions.

In manufacturing the Right Line drill quality has been put before everything else. The methods used have been employed to insure accurate machining as well as the economical handling of the parts. In short every effort has been made to build a machine that will complete the job in a quicker, easier way.

# Famous Machinists of History

By H. H. Manchester

## *James Rumsey (1743-1792)*

James Rumsey was born in Bohemia Manor, Maryland, about 1743. Little is known of his early life except that he was a machinist and practiced that trade for a number of years.

Early in life he turned his attention to inventing, and made a number of improvements in the mechanism of mills. In one called "Barker's Improved Mill," the water passed into the center of the wheel, and out of one side of the spokes, much as in an internal turbine.

In 1784 he exhibited to General Washington the model of a boat to be run by steam, and the next year obtained the exclusive right for ten years to run steamboats in Pennsylvania. In 1787 he built a boat propelled by a steam engine which threw streams of water out of the stern, and made an apparently successful trial trip on the Potomac in front of a large number of spectators. This brought him the rights to navigate the streams of Maryland and Virginia, while the Rumsey Society was formed to further his plans.

He then went to England and obtained patents. In 1792 he had a boat run by steam built for him there and made a trip on the Thames with it.

Unfortunately, however, just as he seemed to be making good progress, he died, and his plans were not carried out.

Nevertheless, the legislature of Kentucky in 1839 presented a gold medal to his son, commemorating his father's services toward giving to the world the benefits of the steamboat.

# Santa Fé Standards for Chisels and Flue-Beading Tools

By Clifford H. French

Chisels and flue-beading tools, for both air hammer and hand use, have been standardized by the Santa Fé Railway system. The latest revision is shown herewith.

With two exceptions, new tools for both air hammer and hand use, are 9 in. long. For smoke-arch tubes and

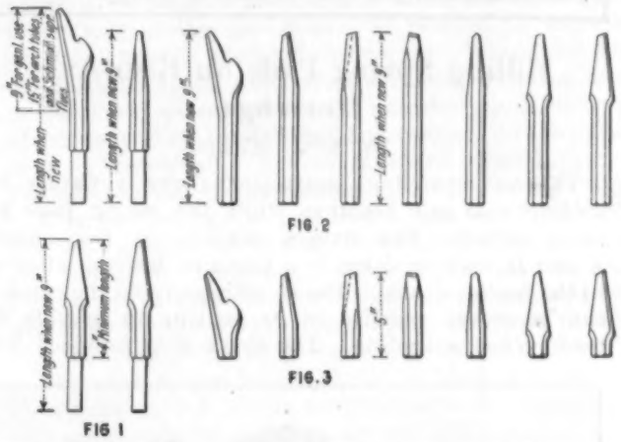



*Fig. 1—Air hammer tools. Fig. 2—New tools for hand use. Fig. 3—Worn out hand tools*

for use in locomotives equipped with Schmidt superheaters, new tools are 15 in. long.

When air-hammer tools break at the shank, they are made into hand tools. When hand chisels and beading tools wear to a length of 5 in. they are scrapped, but can be made into center punches if any are needed. Tools for use in air hammers can be used down to a length of 4 in. as in Fig. 1. Fig. 2 shows new hand chisels and a flue-beading tool, while Fig. 3 shows the same tools worn so they are ready to be scrapped.

# Standardization in Time of Peace

In the booklet, *Standardization*, published by the American Engineering Standards Committee, we read that the way toward greater industrial efficiency is standardization. If our standard of living is to be advanced, or even maintained, in the face of the enormous material losses produced by the war and in the face of the competition of countries with a lower standard of living, there must be increased production. Increased production will be secured partly through invention and the improvement of processes but for the most part it must be looked for in the elimination of waste.

The greatest waste in industry is undoubtedly due to failure to carry out the principles of standardization in a through-going way. Witness for instance the excessive multiplicity of sizes and styles of merchandise. One firm is making 7,500 different varieties of bed casters; three ax manufacturers are making common axes in 34 types, 4 grades, 35 brands, 11 finishes, and 19 sizes, 6,118 varieties being actually listed.

The waste through the creating and keeping of the necessary facilities for making so many varieties, through stoppages due to short runs, and through the keeping of all this material in stock is enormous.

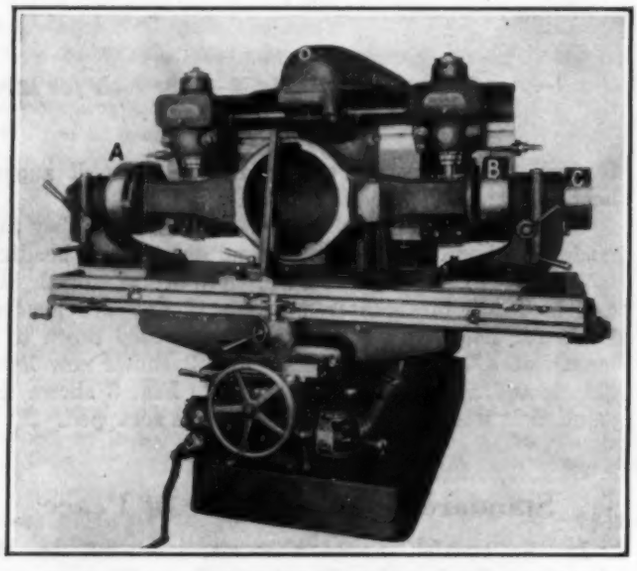
# Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

## Milling Spring Pads on Rear-Axle Housings

By A. G. Miller

The accompanying illustration shows a fixture for holding rear-axle housings while the spring pads are being milled. The fixture consists of two chucks, *A* and *B*, each mounted in a trunnion bearing attached to the machine table. The spindle carrying the chuck *A* can be moved endwise in its bearing to provide for loading and unloading. The chuck *B* is provided with




*Fixture for milling spring pads on axle housings*

an index plate and locking pin so that work held therein can be indexed. Rotation during indexing is accomplished by means of a bar inserted in one of the holes in the hub *C*.

In operation, the work is set in the chucks and the jaws of chuck *B* are drawn up loosely, the chuck being held in one of the indexing positions. The work is then clamped tightly by the chuck *A* and the chuck and work rotated until the banjo portion of the housing is vertical, as determined by the squaring device shown.

The chuck *A* is then clamped in position and the right-hand end of the work securely held by the jaws of chuck *B*. The squaring device is then removed from its base, so that it will not interfere with indexing the work.

Mounted upon the machine column and attached to the overarm is a cross-rail carrying two spindle-heads. These heads are adjustable on the rail to center distances of from 34 to 53 in. and may be solidly clamped to the rail. The spindle in the head at the left is adjustable vertically by a quill, so that cutters held thereon may be brought into alignment with the cutters on the spindle at the right. The work is brought into proper relation with the cutters by vertical movement of the machine knee. The spindles are worm-driven and are operated through a gear train from the main spindle. Arbors in the spindles each carry a pair of 5½-in. side mills. Outboard bearings are provided for the arbors for rigidity.

In order to prevent rocking of the knee under the cut, it was found necessary to provide, in addition to the equipment illustrated, sliding bearings between the outer ends of the cross-rail and the machine table.

In operation, the work is fed bodily to the cutters for the proper distance, by means of the transverse feed, after which the longitudinal feed is used in milling the pads lengthwise. At the end of the cut the table feed is tripped and the saddle is returned at the rate of 30 in. per min. At the same time the table feed is reversed and the table brought to the starting position at the same rate. The work is then indexed 180 deg. and the two opposite portions of the spring pads are milled in the same manner.

The machine used is a No. 5, plain, high-power, Cincinnati milling machine.

The cutters ran at 73 r.p.m. and the feed was 9¼ in. per min. Housings were milled in 6.9 min. each.

## Machine for Turning Round Shanks

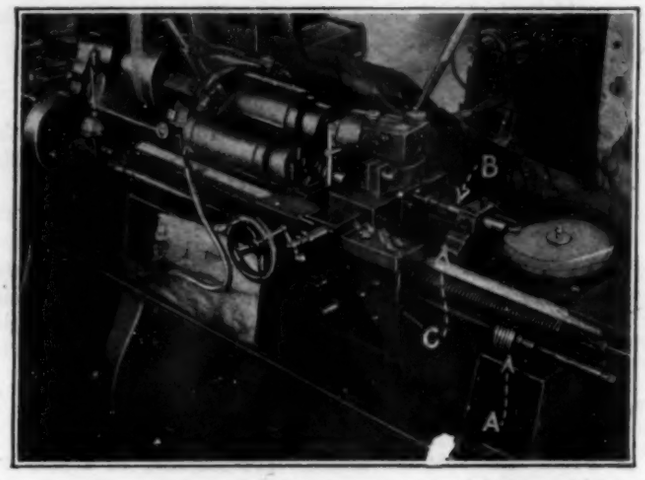
By William Denton

The machine shown in the accompanying illustration was built by the O. K. Tool Co. for turning the shanks of its toolbits, which are manufactured in large quantities. The basis of the machine is a standard engine-lathe from which the regular cross-slide and the tailstock have been removed, the feed mechanism taken out of the apron, and to which the special features here described have been added.

The new cross-slide has in place of the regular toolblock, an elevating and swivelling holder to accommodate a two-jawed chuck fitted with special jaws. The toolbits are of various shapes and sizes, with the shanks standing at many angles, hence a universal adjustment is provided for the holding chuck. The bits are forged in dies by the hydraulic method and are each of one piece with the shank, on which only enough stock is left to finish to size.

The device between the headstock and the carriage is a rocking frame carrying two spindles parallel to the center line of the lathe. From the position shown in the cut, the frame may be tipped back until the other spindle is in line with the lathe spindle. A positive latch holds it in either position.

On the nose of the lathe spindle is a pinion that drives a wide-faced gear on a short shaft, which is the fulcrum upon which the frame swings. The gear




*Special machine for turning round shanks*

meshes with two smaller gears, one on each of the short spindles, so that both the latter are positively driven from the lathe spindle in whatever position the frame may occupy.

On the outer end of each of the short spindles in the rocking frame there is a cutter head, made very much like a standard die head, except that the tools are turning tools instead of thread chasers and the die does not open. The tools of one head are set to turn the roughing cut over the work and those of the other to make the finishing cut.

Though the feed-rod gears, clutches and other parts of the feed mechanism, as well as the split nut of the leadscrew, have been removed from the lathe, the leadscrew itself, together with the change-gear train, the tumbler gears and the feed-reversing lever upon which they are mounted remain in their respective places. The leadscrew, however, no longer serves its original purpose, but acts merely as a shaft to drive the worm *A*, which is the primary member of the new feed movement.

At the rear end of the lathe bed there is a short vertical shaft that carries a two-lobed cam at the upper end and at the lower end a wormwheel to mesh with the worm on the leadscrew. Movement is transmitted from the cam to the carriage through the push-rod *B*, screwed into the bridge of the carriage at one end and carrying a cam roller at the other. A guide, *C*, bolted to the shears of the lathe, steadies the push-rod against side thrust of the cam. Coil springs on each side of the bed are attached to the carriage to keep it back as far as the cam will allow.

In operation, the feed cam runs continuously, though it may be stopped or reversed at any time by means of the tumbler-gear lever in the headstock. While the roller is at the lowest point of the cam—either side—the operator puts a toolbit in the chuck, which has been adjusted in accordance with its shape to hold the shank in line with the spindle, and leaves the machine to take care of itself. When the cam has made one-half turn and the roughed shank has been withdrawn from the roughing-cutter head, the operator tips the rocking frame to its rear position and allows the cam to complete its revolution, thus finishing the shank.

There are six of the machines, and one operator attends them all, except when turning very small shanks, when the lathes run too fast for him to keep up with them.

## Device for Testing a Leadscrew in Place

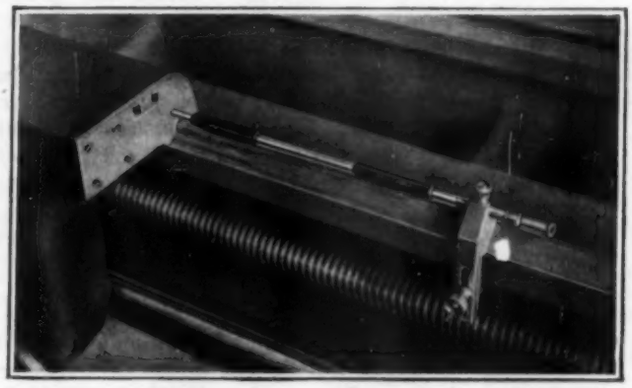
By Jack Williams

The device shown in the illustration is for testing the accuracy of a leadscrew without removing it from the lathe. It was made by J. G. Benson, an inspector for the Reed-Prentice Co., for the purpose of checking screws after assembly and also for testing suspected screws upon lathes that had been a long time in service.

The tool consists of a clamp to go over the front shear, a micrometer head, and as many standard measuring rods as the user desires to provide for himself; one is all that is absolutely necessary. The upper part of the clamp hooks over the lathe shear; a sliding block on the lower extension may be adjusted up or down to accommodate different lathes and clamped to the extension by means of a knurled nut and a stud passing through the slot in the extension.

A large faceplate is put on the spindle of the lathe and with a sharp scriber in the toolpost, a short line is laid along the horizontal radius. The lathe is then geared to cut some standard pitch of thread that will divide evenly into inches and common fractions thereof, and the locknut closed.

The lathe is then turned slowly by hand until the line on the faceplate registers with the scriber. Care should be exercised to stop at exactly the right place, as the



*Device for testing leadscrew errors*

slightest turn backward will introduce backlash errors that will render the readings of the device valueless or misleading. With the scriber on the line, the clamp is tightened on the shear so that with the measuring spindle of the micrometer abutting against the carriage or against a measuring rod that has been interposed between it and the carriage, the micrometer will read zero.

The spindle is then turned, carefully, one, two, or any desired number of turns, and another reading taken from the micrometer. A moment's calculation will show what the reading ought to be; the micrometer will show what it *is*—the difference will be error of the screw.

With the lathe geared to cut, say, 16 pitch, and with a 2-in. rod between the micrometer and the carriage, the micrometer is set at zero. The lathe is then turned 16 turns, or any multiple thereof, and the corresponding rod substituted for the first one. The micrometer should still read zero.

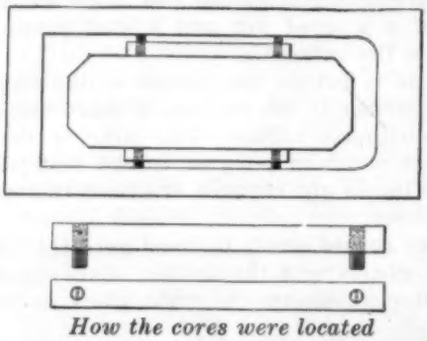
The advantages of this device are: its portability; with it a screw can be tested without taking it out of the lathe; and that tests can be made over minute portions of the screw at any part of its length.

## Setting Cores in Rubber Molds

BY BEN FRANTZREB

Having to set eighteen cores exactly central in a corresponding number of rubber molds, the space on each side of the cores varying between 0.392 and 0.395 in., I adopted the following expedient to locate them correctly:

I took two pieces of ⅝-in. square cold-rolled steel of suitable length, drilled and tapped two holes for 10-32 screws through each near to the ends, put in headless setscrews a trifle shorter than the thickness of the material—letting the point ends of the screws project a slight amount above the surface—and then ground them off flush on a die-grinding machine. Turning the pieces over on the machine I then ground the opposite surfaces, making two accurate parallels with adjusting screws in each.



*How the cores were located*

It was then an easy matter to set out the screws until the distance from the ground ends to the opposite side of the parallels was exactly equal to the space in the molds, measuring the distance with a micrometer.

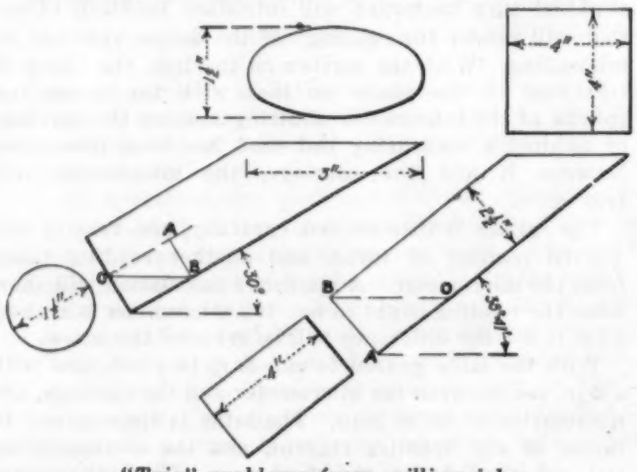
Once the screws were adjusted to give the right spacing and the parallels laid in the spaces alongside of the cores, there was no possibility of getting them misplaced.

## A Problem in "Trig"

BY JIM HENDERSON

Recently I was asked by a young machinist if I could enlighten him on a milling machine job, simple in itself, but requiring a little knowledge of trigonometry for its solution. The problem is illustrated in the accompanying sketch.

A number of short shafts 1½ in. in diameter required



*"Trig" problems from milling jobs*

milling on one end so that the surface would have the shape of an oval, the long axis being 3 in. and the short axis being equal to the diameter of the shaft. It was necessary to know the angle at which the work should be inclined when milling. The angle is at *O* in the triangle *AOB*, and is found by the formula

$$\text{Sine } O = \frac{\text{Side opposite}}{\text{Hypotenuse}} = \frac{AB}{OB} = \frac{0.75}{1.5} = 0.500$$

From a table of trigonometric functions the angle corresponding to a sine of 0.500 is 30 degrees, and this is the angle of inclination of the work.

A similar problem is also shown, in which a short shaft of rectangular cross-section (4x2½ in.) requires shaping on the end to form a square surface 4 in. long on a side. The solution is the same as in the previous problem, and the sine of the angle *O* in the triangle *AOB* is found by dividing the side opposite the angle by the hypotenuse.

$$\frac{AB}{BO} = \frac{2.5}{4.0} = 0.625$$

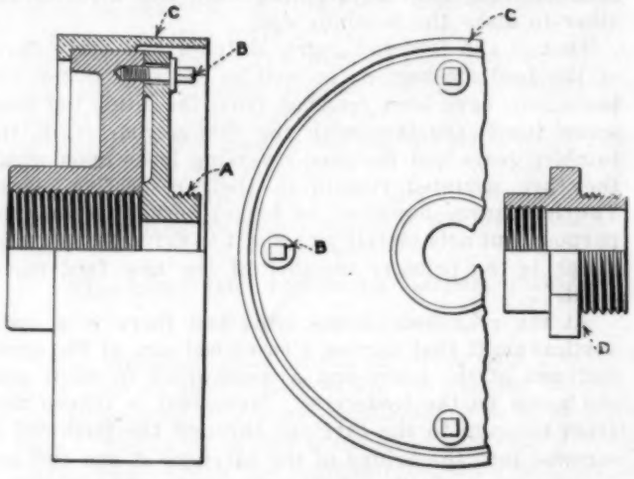
From the table the angle corresponding to a sine of 0.625 is 38 deg. 41 minutes.

## Fixture for Facing Safety-Valve Seats

BY V. T. KROPID

In facing safety-valve seats it is not practical to mount the bodies on a rigid, threaded-mandrel for the reason that they will not run true.

In order to provide means for holding the safety valves and at the same time to allow their position to be shifted to make them run true, one of the lathe hands




*Mandrel for facing safety-valve seats*

in the Winona, Minn., shops of the Chicago & North Western Railway devised the fixture shown in the accompanying illustration.

The threaded and flanged mandrel *A* is attached to the small faceplate of the lathe by four capscrews as at *B*. The holes in the flange are ⅛ in. larger than the capscrews, so that the mandrel can be shifted in relation to the axial center of the lathe. The ring *C* was put on to prevent injury to the workmen from the projecting heads of the screws.

With the body of a safety valve screwed on the mandrel *A*, and the screws *B* slightly loosened, it can be so positioned that the seat will run true, by tapping it with a hammer in one or another direction. Tightening the screws will hold it firmly in position while the seat is being faced. Adapters, such as shown at *D* can be made to screw on the mandrel. The externally threaded ends can be of various sizes to fit such work as it is desired to mount on the mandrel.

# Technical Abstracts

## The Vertical Trust

This article by Dwight T. Farnham is well worth studying as it gives a clue to some of the reasons for the success of such manufacturers as Henry Ford and lays bare the general policies which seem to actuate concerns like his in building up their business. The vertical trust is a consolidation of a number of industries of such a sort and in such a manner that the finished product of one is the raw material of the next. The horizontal trust is a consolidation of industries manufacturing a single product, as matches or automobiles. Perhaps the best developed vertical trusts are found abroad, particularly in Germany where circumstances, combined with the German talent for organization, have united to create a type of super trust of a stupendous nature, for example, the Stinnes Konzern. This concern in 1923 comprised 65 iron ore mines, 26 coal mines, 26 blast furnaces, 24 rolling mills, 12 kinds of steel plants, besides automobile plants, transportation companies, rail, river and ocean, and newspapers. There is a plant for drying fish and another plant for turning out microscopes. The A. E. G. of Germany is nearly as large as the Stinnes Konzern and has no fewer than 872 factories and branches producing iron from the ore and coal right up to the finished products.

In France, the Schneider interests, in Italy the I. L. V. A. and in England Lever Bros., the soap people, and also the Vickers Co., are building up vertical trusts. In this country there would seem to be only Henry Ford with his ore lands in Michigan, coal mines in West Virginia, his railroad, transportation by water, and his River Rouge plant, all going to building up the final product.

There is a slight tendency in the General Motors organization but so far, very slight. There is also a tendency shown by Charles M. Schwab to build up the vertical trust type of organization, particularly noticeable since his entry into the automobile business.—*Industrial Management*, May, 1924.

## The Italian Iron and Steel Industry

The peculiarity of Italy's iron and steel industry springs from the fact that the country has no coal and has iron ore deposits of some importance only on the Island of Elba, while on the other hand it has exceedingly great water power resources in many parts of the country. Electric steel is therefore a very important product and most of it is manufactured from scrap iron of which, under normal conditions, a great deal is imported. The rolling mills are usually small and very diversified so as to take care of the small Italian orders. The Fiat concern, renowned the world over for its automobiles, also operates a considerable number of electric steel furnaces, thus producing its own raw materials used in making many parts of the automobile.—*Die Werkzeugmaschine*, July, 15, 1924, p. 271.

## Steel Tools and Their Treatment

Factory Engineer Kurt Ruschpler gives some practical directions for the correct treatment of modern tool steels. The highest grades of tool steels show considerable toughness even when hardened, the cheaper grades are brittle. Evenly and slowly working tools can be made very hard; tools subjected to shock must be left tougher, even if somewhat softer. The correct hardening temperature for modern steels is about 720 deg. C. At higher temperatures carbon is eliminated from the surface of the steel and hardness is not attained at quenching. The critical or recalescence point can in modern work be determined by the double mirror galvanometer of Saladin. In heating one must be careful not to get edges and corners hotter than the body of the steel. When using coke fire it is well to put a piece of sheet steel between the steel and the fire. Coal fire is objectionable, both on account of sulphur contamination and difficulty to secure uniform heating. Of open fires, the charcoal fire is the best, but in all up-to-date works heating furnaces are usually given the preference.

The hardness is indicated by fine grain and failures are best studied with the aid of the microscope. Coarse crystals with intermixed white grains show overheating. Thorough coarse crystallization indicates too long heating before hardening. Lacking uniformity shows too rapid heating. Such rapid heating and unskilled quenching cause warping. Tools which have been forged a number of times must be annealed before hardening to relieve internal stresses. Tools of heavy section must not be quenched in water, but while they are still sizzling, must be plunged into oil. This must be done with great rapidity. When the sizzling ceases there is danger of sharp shrinkage and cracks. It is well to withdraw the tool from the water and return it to the fire before this time and then heat the exterior layers somewhat to relieve strains. The tools may then cool in a warm place. This is applicable especially to thick tools, like milling cutters, punches, etc. Thinner tools are better tempered on hot sand or on sheet steel in the fire.—*Die Werkzeugmaschine*, July 15, 1924, p. 261.

## Five Permanent Mold Casting Processes

The five processes discussed are: Die casting, slush casting, Cothias casting, centrifugal casting, and permanent mold casting. Die casting is defined as a finished or practically finished casting, made by forcing liquid metal or alloy into a metallic mold or die. Very little machining is required to put the casting into condition for use. Slush casting is made by pouring a liquid metal or alloy into a metallic mold, followed by immediately inverting the mold and thereby pouring out the excess unfrozen alloy in the center of the mass, thus leaving only the shell formed by the contour of the mold. This is mostly used in the production of vases, dolls, statues, etc. Cothias casting is a finished or semi-finished casting made by first pouring the liquid alloy into a metallic mold and then forcing the top half of the mold containing the cores into the alloy while liquid, thereby giving internal shape to the casting. Centrifugal casting is defined as a finished or semi-finished casting made by pouring liquid alloy into a rotatable permanent mold followed by rapid rotation so that the alloy is forced to the walls of the mold. Practically any cylindrically shaped body can be made by centrifugal casting. Permanent mold casting is defined as finished or semi-finished casting made by pouring liquid alloy into a metallic mold, which enters the mold and fills the cavity solely under the force of gravity. *Automobile Industry*, July 31, p. 252.

## Building Tractors Under Scientific Management

George D. Babcock, manufacturing executive of the Holt Manufacturing Co., continues a series of articles dealing with the organization of the personnel for production. As the work proceeded the problem shaped itself into the following elements:

1. The establishment of a functional organization with the duties pertaining to each function clearly defined.
2. The acquirement of exact knowledge concerning the limitations of the product and the methods of obtaining it.
3. The formulating of manufacturing programs to meet the expected demand for the product in the most economical manner with a minimum tie-up in inventory.
4. Control of the material supply to the end that there should never be a stoppage of production due to shortage of material.
5. The establishment of the best possible relations between employer and employees.

The article deals with an elaboration of these five main points.—*Management and Administration*, Aug., p. 141.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

## *A Milestone in Engineering Development*

COMPARATIVELY few of our present-day educational institutions have survived the vicissitudes of one hundred years of existence. This week marks the first entrance of an American engineering school into this class. The event is being celebrated at Troy, N. Y., where a notable group of alumni and distinguished engineers from all over the world are gathered to honor the hundredth anniversary of the founding of the Rensselaer Polytechnic Institute.

It is a long step from the comparatively simple applications of science and engineering of 1824 to the varied and numerous ramifications of the many branches of engineering in 1924. This marvelous development has been in great measure due to the careful training of technical men and scientists in such institutions as the Rensselaer school. It is not a large institution, even today, although it has kept in step with the march of technical development, but it numbers among its graduates such men as Roebling of Brooklyn bridge fame, Cassatt of the Pennsylvania, and many others, equally distinguished but perhaps not so generally known.

It would be difficult to overestimate the effect that such an institution has had on modern life. When it was founded Fulton's trip in the Clermont was a comparatively recent event; the first canalboat was yet to make a complete trip from Buffalo to Albany through the Erie canal; George Stephenson and his "Rocket" were not to perform in England for another five years; and electricity was lightning.

To the Rensselaer Polytechnic Institute we offer our sincere congratulations on its birthday, and hope that its efforts in the development of engineers to cope with the problems of modern industry will continue to prove successful for many years to come.

## *Prevention vs. Cure*

THERE is a good deal of truth in the saying, "An ounce of prevention is worth a pound of cure," especially when this practice is applied to destruction by fire. Fires in the past have been costly and will continue to be costly until every one learns that by precaution this destruction may be prevented.

Not only is the loss of property to be considered, but also the loss of orders, the loss of time, the possibility of the loss of life, and other set-backs that no amount of insurance can cover. Your business, your prestige, your income and perhaps your life are in the balance.

More lives are sacrificed and more property destroyed by fire than by electricity simply because electricity has been placed under control and kept there. Equally as many measures should be taken to keep fire from destroying as are used to keep other forces from being turned away from their useful purposes to destructiveness.

Only by some sort of a concerted effort can fires—particularly in manufacturing plants—be curbed. Making drastic and unnecessary rules and then forgetting them, filling water buckets when they are new only to have the water evaporate, and the placing of "No smoking" signs every few feet only to have men strike matches on them will not prevent conflagrations. But sensible rules rigidly enforced, reasonable precautions and periodical inspections will do much toward saving irretrievable loss by fire.

Perhaps the best time to start prevention is during the week of Oct. 5 which has been set aside as Fire Prevention Week. But the time to stop isn't Oct. 11 when the drive is over. Fire prevention should be routine duty detailed to the most responsible men in the organization and as strictly performed as the other important duties.

## *Give the Railroad Shop Foreman His Due*

THE railroad shop executive is confronted by many problems that are different from those encountered in the average machine shop. In reality the nearest approach to railroad shop work, so far as its requirements are concerned, is probably the service station where a large fleet of motor trucks must be kept in order so as to be on the job as constantly as possible. Another similarity can be found in the maintenance department of any large machine using plant.

In all these shops the main object is to get the machine back in service as soon as possible. The cost of machining is frequently less important than the loss of service of the locomotive or other machine. But there is no excuse for not using the best machines and the best methods.

Work of this kind has the disadvantage of being more or less special so that manufacturing methods cannot be used to any great extent. On the other hand there is enough similarity to the repairs made to enable men to become skilled at handling special jobs. Driving boxes, shoes and wedges, hub liners, tire and wheel work, crossheads and rod brasses form a large percentage of the work in a railroad shop and men become very expert in handling repairs of this kind. Some pieces, such as crankpins, are frequently turned up in the rough with an allowance for finishing to fit the particular locomotive for which they may be needed.

One advantage of this kind of work, from the point of view of the all-around mechanic, is the variety of work which a railroad shop affords. On the other hand the large railroad shop has to specialize its men along different lines in order to be able to use men of varying grades and qualifications. The growing use of autogenous cutting and welding, electric welding and the increasing development of electric traction are adding to the variety of work to be done and to the responsibility of the foreman and other executives. There is probably no other line of work in which the forman has to be familiar with so many varieties of mechanical work as in a railway shop. And there are few other lines in which the foreman is so little appreciated by the management or so poorly paid for his knowledge and his services. A good foreman can do enough to promote harmony, to secure co-operation and to keep down costs to entitle him to greater consideration, financial and otherwise.

# Shop Equipment News

## Warner & Swasey No. 1-A Hollow Hexagon Turret Lathe

The Warner & Swasey Co., Cleveland, Ohio, is now marketing an additional model of its hollow hexagon turret lathe, designated the No. 1-A. The machine embodies a number of improvements that have been made to secure an increase in power, rigidity and ease of operation. It is adapted to secure the full advantages of the use of high-speed steel tools, and for work on which the limits of accuracy required are close.

In general type the machine is similiar to the turret lathes manufactured by this company for many years. Among the improved features are included an all-steel geared head, an increased number and range of feeds, a quick method of changing the feeds in the aprons of the carriages, a recently developed turret binder mechanism, and betterments in tooling. The double-carriage design is continued and the machine is arranged for the high production of a wide range of work.

In Fig. 1 the machine is illustrated as equipped for bar work. The collet of the automatic chuck will accommodate round bars 2¼ in. in diameter and the maximum turning length is 26 in. The machine shown in Fig. 2 is arranged for chucking work, being provided with a 12-in. chuck. The machine arranged in this manner has a maximum swing over the carriage of 13¾ in. and a 16¾-in. swing over the ways.

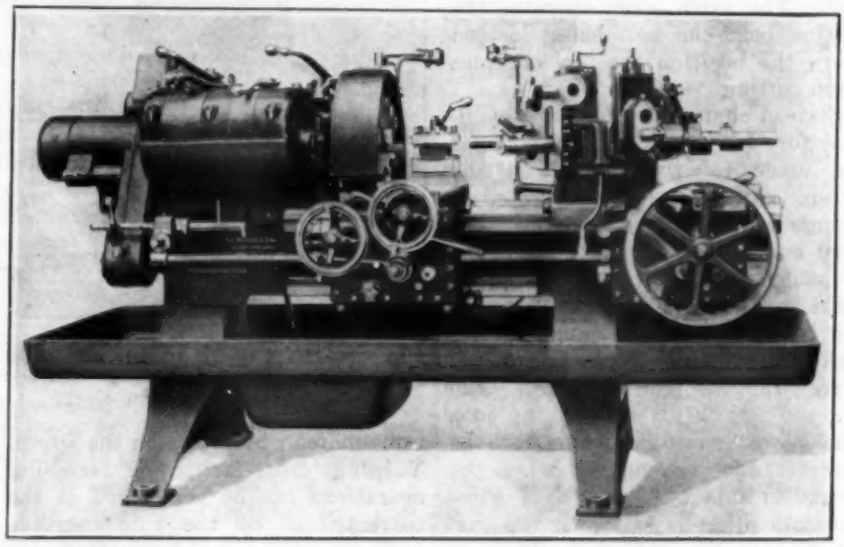


*Fig. 2—No. 1-A turret lathe fitted for chucking work*

In the design of the machine an effort has been made to make the operation of the machine easy and convenient. To this end the levers that control the spindle speeds in the head are located within easy reach and the feed changes are effected by levers on the aprons. A power rapid traverse decreases the effort necessary to move the turret.

As in the other machines of this line, the head is cast integral with the bed to insure rigidity. The gears in the head are shown in Fig. 3 and are made from heat-treated steel. The gears operate in an oil bath and provide 12 spindle speeds, both forward and reverse. The speeds range from 20 to 477 r.p.m. Three levers on the top of the head control the speed changes. Starting, stopping and reversing of the machine is done by the long lever above the front bearing of the head, this lever operating a double friction clutch on the back shaft.

The machines illustrated are arranged for belt driving through a single pulley, but a motor drive can be supplied, if desired. The usual method of mounting the motor is to attach it to a head-end leg of the machine, from which position it drives through a belt on the single pulley. In case it is desired to keep the entire motor-drive arrangement within the floor space occupied by the machine itself, the motor may

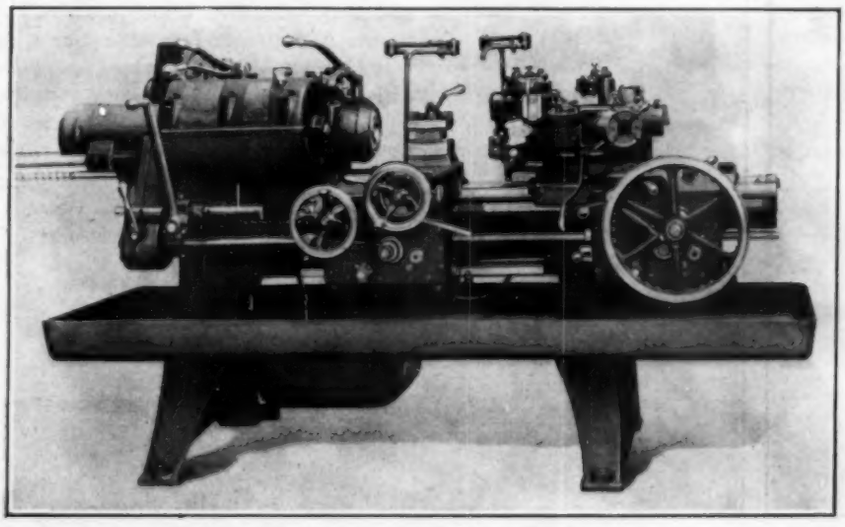


*Fig. 1—Warner & Swasey No. 1-A turret lathe arranged for bar work*

be mounted on the cover plate of the head and connected to the drive shaft of the machine by a silent chain.

The standard hollow hexagon turret is furnished and is shown in Fig. 4, together with the recently developed and patented binding mechanism disassembled. The details of this mechanism are apparent from the illustration. A two-part collar with an internal V-groove embraces a tapered flange on the bottom of the turret and a similar tapered flange on the turrent seat. The two halves of the collar are pulled together by right- and left-hand screws operated by a hand lever, thus binding the turret firmly on its seat. The same lever operates the locking bolt, the bolt being located below the position the tool occupies when cutting.

Sixteen changes of feed are available for the turret. Eight changes are made by two levers on the apron. Another lever operates a change gear in the gear box at the head end of the machine, by means of which an additional series of eight feeds can be obtained through the two levers on the apron. This makes a total of 16 feeds for the turret, ranging from 0.0045 to 0.120 in. per revolution of the spindle. The power rapid traverse for the turret cannot be engaged when the turret is under feed and is automatically disengaged when the turret reaches the end of the bed. It is operated by a single lever, the lever being moved in the direction of traverse desired.

The side carriage is mounted on the front Vee and does not extend across the ways, being gibbed to a lower dove-tailed bearing on the front of the bed. The entire carriage may be moved to the left past the chuck and out of the way of the turret saddle when not in use. A square turret is mounted on the side carriage and will hold four or more tools. This turret is indexed without being lifted from its seat and may be clamped in any position by a quarter turn of the binding screw.

The same number and range of feeds that are available for the turret are also available for the side carriage and are controlled in the same manner by levers on the apron. Turning, cross-facing, or recessing operations can be performed at the correct feed by the side carriage tools at the same time that the hexagon turret is engaged in drilling, boring or turning at the proper feed. The cross travel of the square turret is 8¼ in. and the longitudinal travel of the side carriage is 22¾ in. The range of feeds in the side carriage is available for either cross or longitudinal travel of the tool.

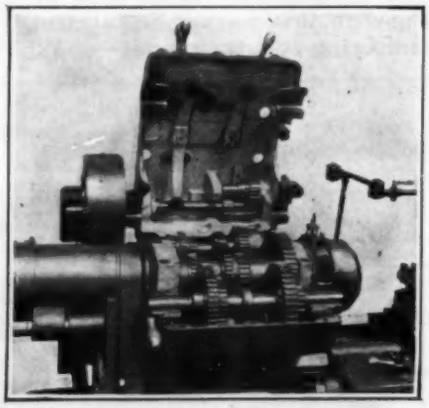


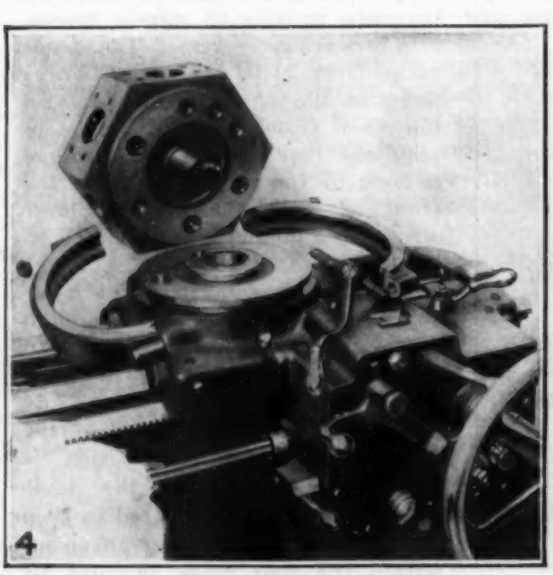
*Fig. 3—Head gearing of No. 1-A turret lathe*

The standard tool equipment for both bar and chucking work may be adapted for a wide range of production requirements without the use of special tools. An overhead piloted turning tool is now furnished as a standard accessory and is illustrated in Fig. 5. The pilot bar is held adjustably in the body of the turning head, and enters a bushing so mounted on the head of the machine as to provide suitable adjustment. These adjustments are useful in correcting any misalignment that may occur. The overhead arrangement provides a pilot when a center pilot bar cannot be used and increases the rigidity of the machine and tools when it is possible to use both overhead and center bars.

## Landis 1½-In. Reverse Taper Diehead

In order to overcome the difficulty in threading crown bolts, in which the present practice of threading the bolt from the small to the large end sometimes causes the nicking of the body of the bolt, the Landis Machine Co., Waynesboro, Pa., is now marketing a 1½-in. reverse taper diehead. This device cuts the thread from the large end to the small end of the bolt.

When this diehead is used, the square on the end of the bolt does not have to be true with the body as the bolt is gripped on the body and not on the square. The device is 11⅛ in. in diameter and 7⅞ in. in length. The maximum diameter of bolt that can be threaded is 1⅞ in.



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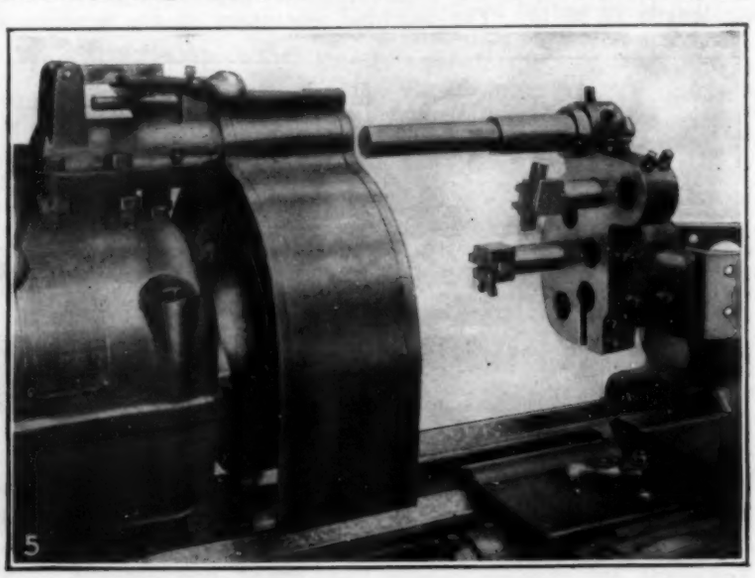

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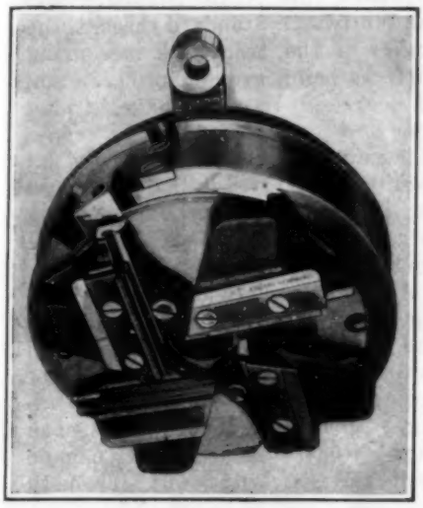
*Fig. 4—Hollow hexagon turret and binder. Fig. 5—Overhead piloted turning tool*

and the maximum taper of thread is 2 in. per foot.

The head can be applied to any Landis threading machine with a capacity of 1½ in. or more. The machine must be equipped with a leadscrew attachment to insure a thread of perfect form and correct lead. A special carriage front or trip-rod brackets will also be required to accommodate the two trip rods that are supplied with the head.



*Landis 1½ In. Reverse Taper Diehead*

The diehead is operated by two trip rods attached to the carriage front of the machine and fitted with adjustable nuts to engage the lugs of the yoke ring. The lugs are placed diametrically opposite each other and the adjustable nuts are so located that they contact with the lugs when the work is about to enter the head.

As the work advances, the yoke ring is pushed back, taking with it the operating ring to which the cam shoes are attached. The cams are designed so that, as the shoes slide over them, the diehead is closed gradually to correspond to the taper of the thread. A set of cams is required for each taper.

The travel of the cam shoes must equal the length of the thread and the diehead opens when the crest of the cam shoes passes the crest of the cam. Stop screws limit the opening of the head and the head is automatically brought to the threading position as the carriage is withdrawn.

## Brown & Sharpe No. 264 Inside Micrometer and Handle

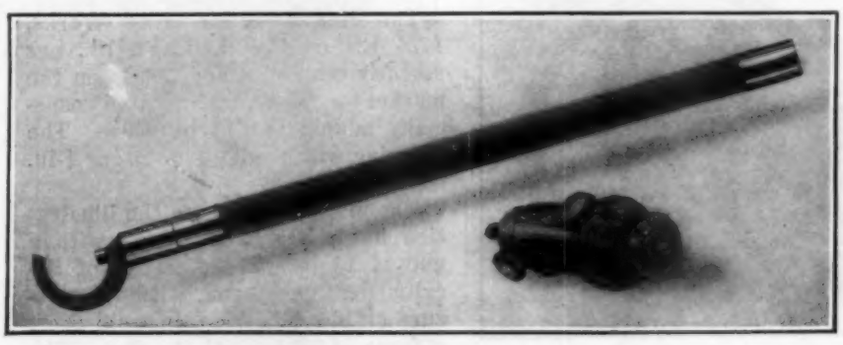
The Brown & Sharpe Manufacturing Co., Providence, R. I., has recently placed on the market its No. 264 inside micrometer and a handle by which the instrument can be conveniently manipulated in small holes. A set of extension rods is supplied by which the micrometer is given a range of measurement from 2 to 8 in. by thousandths of an inch.

The complete instrument consists of a micrometer head with a range of ½ in., six rods and one spacing collar. The shoulders on the rods fit into the micrometer head and when in position, the first half of the inch can be measured, as from 3 to 3½ in. With the spacing collar in place on the end of the rod, the last half of the inch can be measured, from 3½ to 4 in., for instance.

The principle feature of the micrometer head is the clamping device, the essential features of which are shown in the accompanying illustration. The outer shell is slit in two places, the metal between the slots forming a shoe which can be forced against the thimble by means of a thumbscrew. This clamping arrangement is an improvement on this type of inside micrometer as it permits the locking of the thimble at any reading and prevents its turning while in use.

The measuring ends of the rods are hardened and are designed so that it is possible to adjust or compensate for wear. This is done by loosening the lock nut and turning the screw with the hardened end as required.

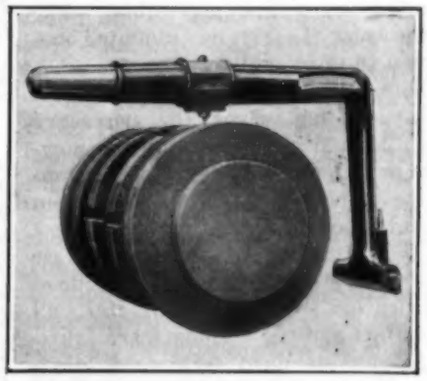
The handle consists of a hook with an adjustable brass plug that is pressed against the micrometer by turning the knurled shank. The hook fits snugly around the head and the brass plug will not mar the tool.



*Brown & Sharpe No. 264 Inside Micrometer and Handle*

## Herbert 24-Kilogram Pendulum Hardness Tester

In addition to its standard 4-kilogram pendulum hardness tester, previously described on page 817, Vol. 58, of the *American Machinist*, Edward G. Herbert, Ltd., Manchester, England, has recently brought out a 24-kilogram device. The large pendulum is adapted for testing large work. It will be marketed in this country by the Tinius Olsen Testing Machine Co., 500 N. Twelfth St., Philadelphia, Pa.



*Herbert 24-Kilogram Pendulum Hardness Tester*

The 24-kilogram device is identical in principle with the former smaller model. It can be used for testing shafts or rolls up to 30 in. in diameter, and at any point on plates or other flat surfaces up to 30 in. wide. It is also adapted for use on drums or large gears of any diameter and up to 30 in. wide, and can be used inside a hole such as the bore of a gun or a large bearing.

The pendulum weighs 24 kilograms and is pivoted on a steel ball 3 mm. in diameter. Adjustable weights are provided, by means of which the center of gravity of the pendulum can be brought to the center of the ball. The length of the pendulum is adjusted by a central weight mounted on a micrometer screw.

## Chicago Straight-Line Two-Stage Air Compressor

A recent addition to the pneumatic equipment marketed by the Chicago Pneumatic Tool Co., 6 East 44th St., New York, N. Y., is an air compressor of the two-stage type with the cylinders arranged in line. The machine may be driven either by motor or belt and is designated as Class N-CTB. It operates at 275 r.p.m. and has a piston displacement of 360 ft. per min. Air pressures range up to 125 lb. per sq. inch.

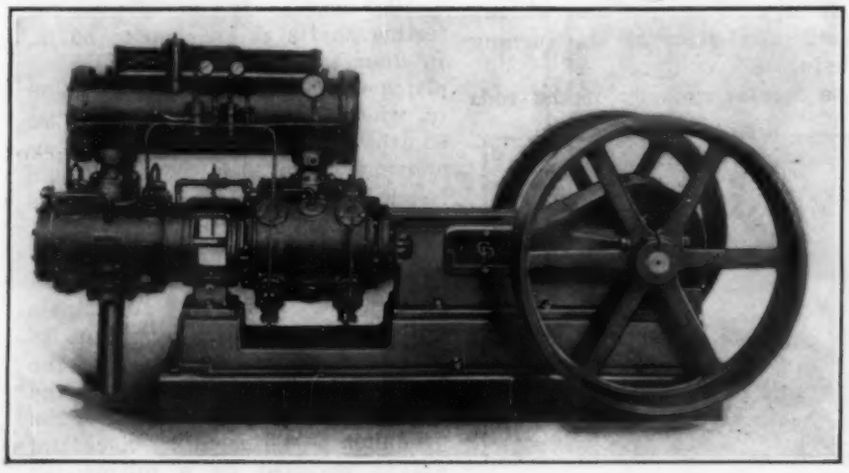
The tandem design has been used in an endeavor to produce a two-stage compressor of comparatively small piston displacement at a reasonable cost. This design is less costly than the duplex type, but makes available the savings due to two-stage compression. The low-pressure cylinder is placed next to the frame and the high-pressure cylinder is connected to it by a tandem-piece through which the piston stuffing-boxes are accessible. The intercooler is rigidly mounted between the two cylinders.

The entire unit is mounted upon a sub-base that gives the necessary rigidity and alignment for the moving parts. In the design of the machine especial attention has been paid to accessibility of parts and ease of adjustment. "Simplate" air valves are used. Splash and flood lubrication are employed for all bearings and the cylinders are lubricated by standard sight-feed lubricators, or pneumatic or mechanical force-feed lubricators.

Automatic regulation of the pressure and volume of the air delivered is provided. This is done through the action of two differential unloaders operating "Simplate" automatic unloading inlet valves. The mechanism causes the compressor to operate at full, half, and no load, according to the air demand. When the compressor is driven by an electric motor and there are periods in the day when the air is not required an automatic start and stop control can be used.

In this case, the unit is equipped with a centrifugal unloader that causes the unloading inlet valves to be held open during the period in which the machine is at a standstill and remain open until the compressor has again started and nearly regained its normal speed. A pneumatic water-control valve automatically stops the flow of cooling water through the jackets and the intercooler during the stationary periods.

If the air demands on the motor-driven compressor are large and steady during a prolonged period of the day, and are intermittent at other periods, a combination of the above two systems can be employed. Either can be thrown into operation in a short space of time.



*Chicago Straight-Line Two-Stage Air Compressor*

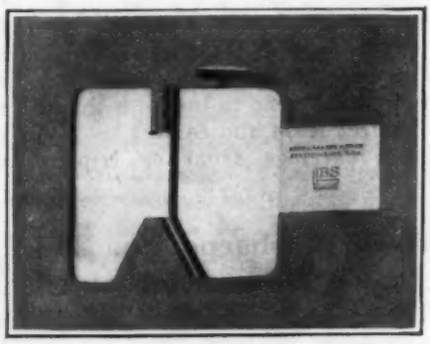
## Brown & Sharpe No. 577 Thread Tool Gages

A series of three gages for measuring and checking thread cutting tools is a recent addition to the line of small tool equipment manufactured by the Brown & Sharpe Manufacturing Co., Providence, R. I. One of the gages is shown in the accompanying illustration.

With these gages it is possible to measure or check threading tools for all shapes of threads from a sharp V-thread to one with a 1-in. flat. They are made of good-quality steel and the angles of the measuring surfaces are hardened, ground and tested for accuracy. The use of the gages for checking purposes is convenient because all widths of flats within a given angle can be obtained.

The three gages cover the U. S. Standard, the Acme Standard and the Whitworth Standard threads, the angles of the respective measuring surfaces being ground to 60, 29 and 55 degrees. To set a gage, a plug gage or a piece of stock of the proper dimension to suit the width of flat required is inserted in the opening on the top of the gage. This opening corresponds with the opening at the top of the angle.

A single gage will cover a comparatively large number of pitches and is therefore more versatile and convenient than the large number of ordinary thread tool gages necessary to cover a series of pitches. The gage with the 29-deg. angle can be used for checking tools for both screw threads and worm threads. Since the widths of flats on 29-deg. worm and screw threads are different, a single ordinary slot gage cannot be used for both worm and screw threads, and an extra series of gages to cover the range of pitches would be required.



*Brown & Sharpe No. 577 Thread Tool Gage*

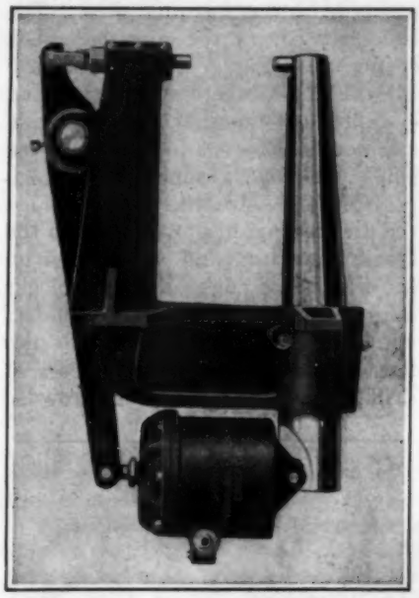
## Hanna Riveter for Light Work

The Hanna Engineering Works, 1725 Elston Ave., Chicago, Ill., has recently developed and placed on the market a riveting machine especially adapted for light work. The machine will handle ⅜-in. hot or ¼-in. cold rivets.

The machine shown in the illustration has a reach of 24 in., with a gap of 13 in. The diameter of the cylinder is 9¼ in. and, with air pressure at 100 lb. per sq. in., will exert a force of 10 tons at the dies. The piston stoke is 7 9/16 in. and the die

stroke is 1¾ in. The total weight of the machine is 1,180 pounds.

The lower or dead stake is made of forged alloy steel, heat treated, and is 6½ in. in diameter at the throat. Foot brackets are cast on



*Hanna Riveter for Light Work*

the frame for mounting the riveter in a stationary position with the reach vertical, dies horizontal, and the cylinder at the bottom.

## Gibb Heating Machines

For heating materials by electricity preparatory to soldering, brazing or welding, the Gibb Instrument Co., Bay City, Mich., is now marketing a line of special heating machines. The construction and operation of these machines is very similar to the construction and operation of either a butt welder or a spot welder.

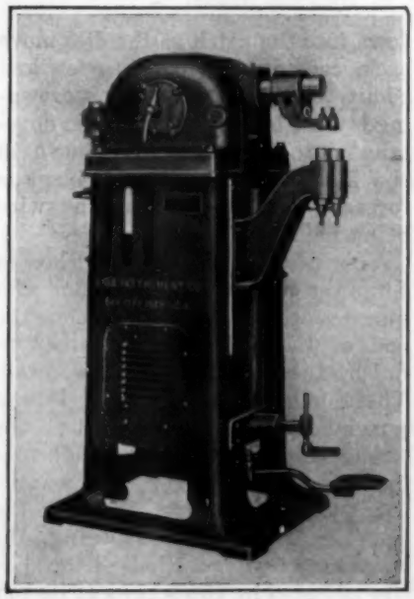


*Fig. 1—Gibb special heating machine for brazing flange on tube*

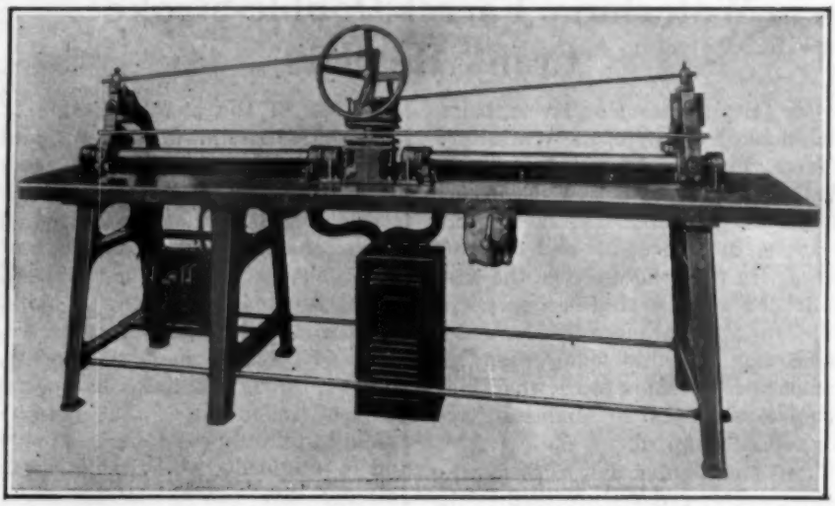


*Fig. 2—Gibb special heating machine for soldering metal frame*

The transformers for the machines are specially built for the service required. The low-voltage, high-amperage current from the transformer is conducted to the contact points through copper conductors of ample capacity. The part to be soldered, brazed, or welded is placed between the contact points, and the current is allowed to flow until the proper temperature of the material is obtained. A six-point switch is provided to regulate the heat in accordance with the requirements of the work.

These machines are especially built to suit the work and the accompanying illustrations show different applications. The machine in Fig. 1 was designed for use in brazing a flange on a tube. This machine replaced the method of heating by gas and is said to have proved itself both faster and cheaper.

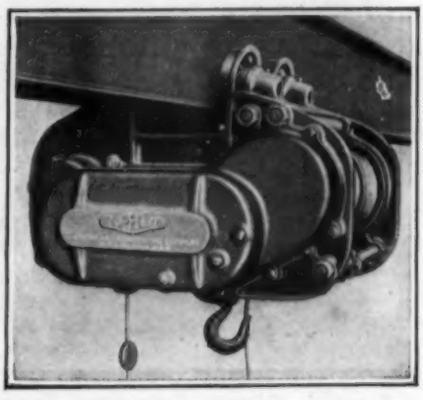
The machine illustrated in Fig. 2 is for the heating of metallic screen frames for the purpose of flowing solder the entire length of the frame into the corner where the metal strip ends meet. When this work was heated by gas the operation was slow and the frames were often warped. The heating current is controlled by a clapper type of switch operated through a push button. It is stated that this machine permits the soldering of the frames in one-fifth of the time previously required and with no warping.

## "Lo-Hed" Type A Electric Hoist

An electric monorail hoist in half-ton and one-ton sizes, and designed to operate in restricted headroom, is now being marketed by the American Engineering Co., Philadelphia, Pa. This hoist retains many of the features of the other "Lo-Hed" hoists manufactured by this company, but is smaller and intended for general utility.

The load hook can be drawn up until it almost touches the rail, thus making the device available for use in places where the headroom is very low. This feature also gives additional clearance for bulky loads and permits placing materials in high piles to increase the storage capacity of warehouses.

Automatic holding and lowering brakes are provided, and a safety device checks the hoist and throws off the current at the upper limit of travel. Roller bearings are used and an automatic system of lubrication is provided. It is stated that the design has a safety factor of five, so that a considerable amount overloading in emergencies is permissible.



*"Lo-Hed" Type A Electric Hoist*

# Waterbury Farrel Double-Stroke Crank Headers

For forming heads on rivets, bolts, etc., made from wire, the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., is now marketing a series of double-stroke crank headers, in both solid- and open-die types. In the solid-die type the wire is headed while located in a recess or hole in a solid piece of hardened steel, this machine being used for comparatively short work that may require accuracy in diameter and high-quality finish.

Two rectangular dies with mating semi-circular grooves are used in the open-die type of machine, the two members being held together under heavy pressure while the heading is being done. This machine is adapted for longer work than the other type, or for a class of work on which the parting line produced by the split dies is not objectionable.

The open-die header is shown in Fig. 1. The crankshaft with its two flywheels is located at the right-hand end and drives the gate carrying the punches, through a pitman and a special self-aligning connection. The dies are mounted solidly in the frame of the machine near the left-hand end, and the feeding mechanism for the wire overhangs at this end of the machine. The wire is fed from a coil between two grooved feeding rolls and then into a quill that extends to the cutting-off die. The wire passes through the cutting-off die, through the rectangular heading dies, and then against an adjustable stop.

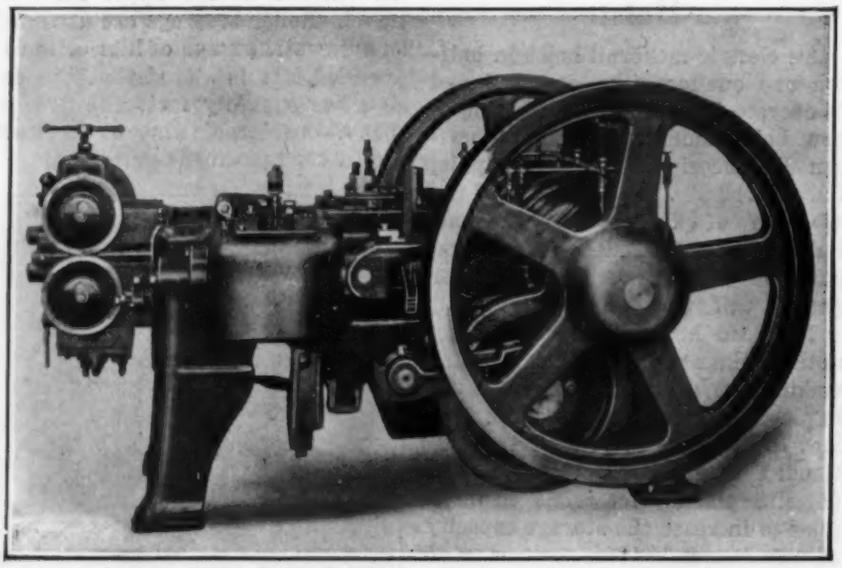


*Fig. 1—Waterbury Farrel Open-Die Crank Header*

A view of the operating side of the machine is shown in Fig. 2, and the apparatus that actuates the feeding mechanism can be seen. The feed is driven from a cam located on the camshaft below and in front of the crankshaft, the amount of feed being adjusted by moving a block, to which the feed arm is connected, back and forth in the slotted rocker. The feed arm oscillates a special form of roller clutch that permits feeding in the forward direction only and is provided with suitable safety features. A convenient lever engages and disengages the feed.

In the open-die header the wire is fed through the dies and the heading dies are then moved a short distance from the feeding line to the heading position. The cut-off die is located against the back of the heading dies and, as these dies move, the wire is sheared off, leaving the length of wire for the finished part gripped in the heading dies. The cap that covers the dies has been swung up in Fig. 3 to show the dies. They fit in a steel-lined pocket and are pressed together by a toggle mechanism located under the cover plate in the background.

After the wire has been headed the dies are again moved back to the feeding position and are opened on the way. The edges of the dieblocks are chamfered so that a 90-deg. notch is formed where the two dies meet. In this notch small pieces of drill rod are located and are crowded

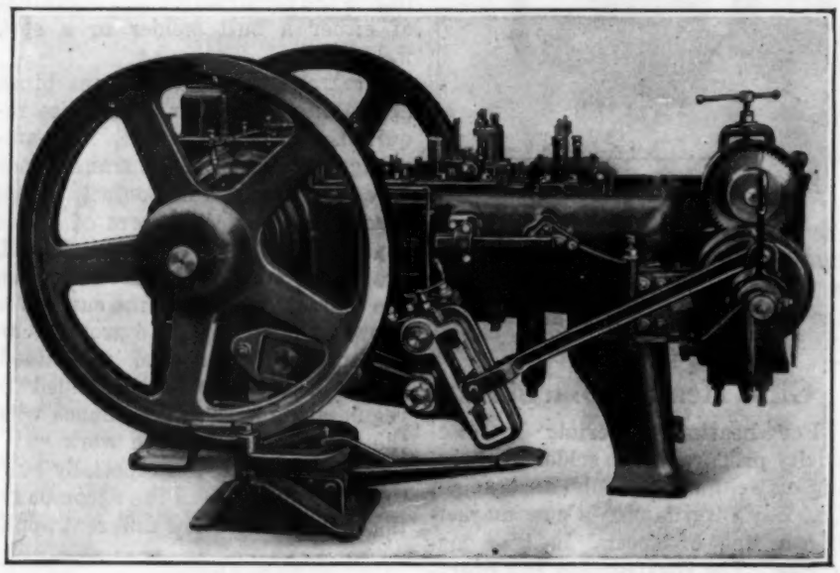


*Fig. 2—Operating side of open-die header*

down into the notch as the dies move back, causing the dies to open and admit the wire freely. The crowding is done by a stationary cam dovetailed into the die-cap as shown in the illustration. The headed blank is forced out of the die by the wire being fed in for the next piece.

This machine uses two strokes to form the head on the wire and two punches are provided, one to cone the end of the wire and the other to finish the forming of the head. These punches are clamped into a punch-holder by draw-bolts, the holder being attached to a slide that is gibbed to move vertically on the front face of the gate. To align the punches with the die opening, the upper and lower positions of the slide are adjusted by two screws at its top.

The punch shifting mechanism is

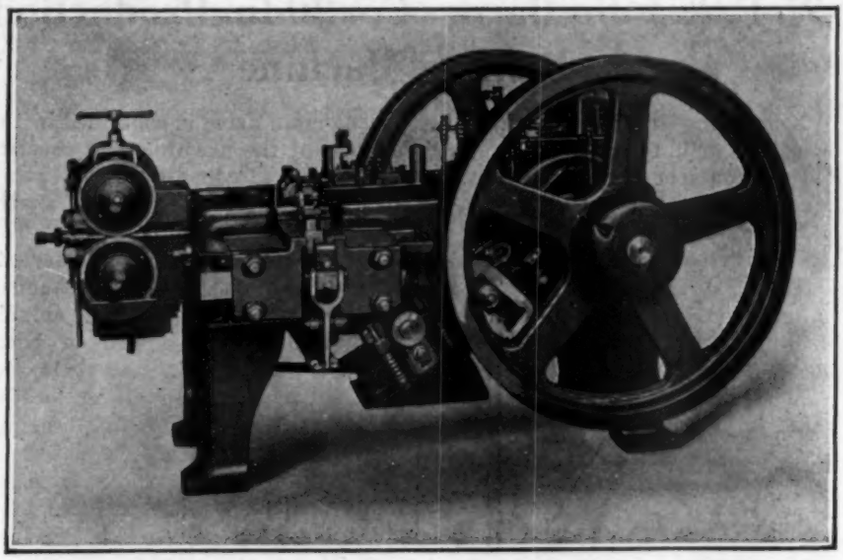


*Fig. 4—Waterbury Farrel Solid-Die Crank Header*

actuated from a rocker shaft beneath the frame of the machine, the motion of this shaft being obtained from the slotted rocker that drives the feeding mechanism. Springs are interposed in the mechanism between the rocker shaft and the punch slide, and compensate for the vertical adjustment of the slide on the gate. This arrangement makes it unnecessary to adjust the position of the punches from beneath the machine.

The connecting-block between the gate and the pitman has an angular face that bears against an adjustable wedge. The wedge is cylindrical in shape on the back and is fitted into the gate so that it bears against the angle of the block. This wedge adjusts the distance between the faces of the punches and dies and is also of use should the machine be stalled on dead center. The cylindrical wedge, together with the special connection between the gate and the pitman, permits the gate to remain properly aligned, so that its movement will be free under all conditions.

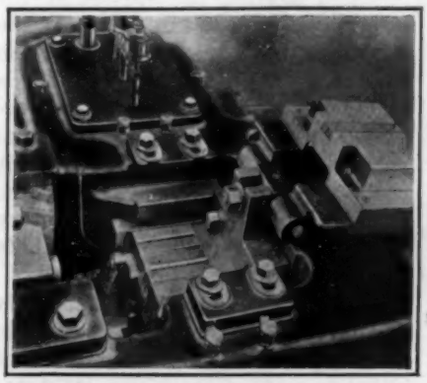


*Fig. 3—Die cap swung up to show open dies*

The solid-die header is shown in Fig. 4. The same form of feeding and heading mechanism used in the other machine is incorporated in this one also. The die is not moved in this design, however, the piece of wire being severed and then presented to the die for the heading opration. The wire is fed through the cut-off die as before and against the adjustable stop, in which position it is cut off by a blade that moves vertically across the face of the die. The cut-off blade is mounted on a cut-off bar that operates through the frame of the machine.

The blade has a semi-circular notch in its edge in which the severed piece is held, after being cut off, by a finger attached to a moving arm called a "fiddle-bow." The knife carries the piece of wire in the semi-circular notch to the heading position, the piece being held in the notch by the finger on the "fiddle-bow" during the transfer. When the first punch advances far enough to hold the work, the knife and the "fiddle-bow" move out of the way and the piece is pushed into the die by the punch. A knock-out pin backs up the work as it is formed by the first punch and pushes the completed piece out of the die after the operation is completed. On the second stroke, the heading punch completes the operation by heading the wire against the face of the die, or in a depression in the die if designed in that manner.

The minimum length of blank that can be handled by this machine is governed by the shortest distance between the first or coning punch and the die at the instant the cut-off knife starts to recede. The minimum length of shank on the finished work is greater if the head is formed in the die than when it is formed against the face of the die. The machines are built in five sizes in each style, giving a complete range of wire diameter from $\frac{1}{8}$ to $\frac{5}{8}$ in. It is stated that the production on the open-die headers ranges from 140 blanks per min. for the smallest to 75 blanks per min. for the largest machine, the production on the solid-die type varying from 125 to 55 blanks per min., according to size. The net weights of the machines vary from 3,600 to 32,800 pounds.

## Van Norman Motor-Driven Ball-Race Grinding Machine

The Van Norman Machine Tool Co., Springfield, Mass., has brought out an improved model of its ball-race grinding machine in which a number of changes have been incorporated, making the machine somewhat heavier than before, as well as

*Van Norman Motor-Driven Ball-Race Grinding Machine*

adding to the convenience of operation.

The main driving belts have been eliminated and independent electric motors applied to all three drives, that is, for the grinding wheel, the work spindle, and the oscillatory movement of the member that carries the work-head. The latter is thus freed from the restrictions heretofore imposed by the necessity for overhead belts, and the work is more accessible to the operator.

Among the features that make for

convenience is a treadle connected to the clutch that disengages the oscillating head from its driving mechanism. The use of the treadle eliminates a hand motion and leaves both hands of the operator free to position the head, load and unload the chuck, and to manipulate gages when necessary.

The wheel and work spindles are surrounded by reservoirs in which oil is maintained and carried continuously to the bearings. A visual oil-level gage is provided on each reservoir.

The cone-shaped bearing supporting the weight of the vertical spindle that carries the oscillating work-head has been made larger to increase the rigidity of this member. An oil reservoir also surrounds this bearing. In addition to the cone bearing, radial ball bearings are located at the upper and lower ends of the shaft to provide against offset wear from the weight of the overhanging work-head.

An important feature of the improved machine is the magnetic chuck for holding the work. This chuck is a product of the Taft-Peirce Co., and was designed especially for this machine. It is of the bi-polar type with a faceplate attached to the chuck body by screws, thus allowing a separate faceplate to be fitted to accommodate each size and type of ball-race that is to be ground upon the machine.

The magnetizing current for the chuck is carried by enclosed wires through the hollow spindle of the work-head from collector rings and brushes mounted within and protected by the driving pulley at the rear end of the spindle. This method of mounting the electrical equipment guards it from any coolant used on the work, and coolant may therefore be supplied through the spindle to the center of the work when desirable. The collector rings are mounted upon a micarta bushing that surrounds the work spindle. The spring-pressed carbon brushes are supported by stationary members of the same material.

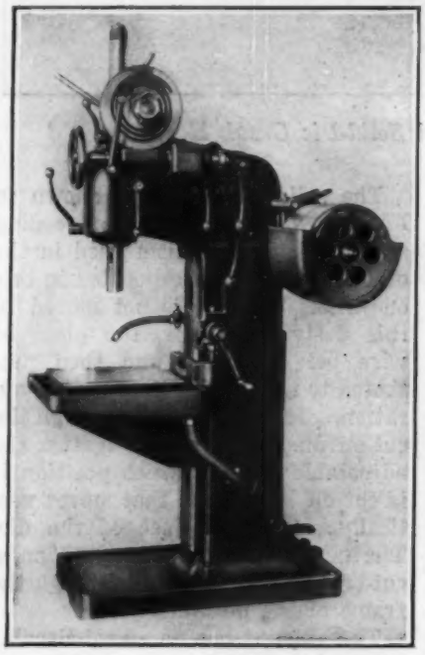
A special demagnetizing switch, also made by the Taft-Peirce Co., is a part of the equipment of each machine. By means of this switch the operator is enabled to cut off the current and demagnetize the chuck by a single movement of the hand.

The machine is made in two sizes, designated as No. 32 and No. 40, for small and large ball races, respectively.

# W. F. & John Barnes Co. 20-In. Production Drilling Machine

A machine to meet the requirements of drilling, reaming, tapping, boring, couterboring, spot facing, or other combinations of operations, on a high-production basis is now being marketed by the W. F. & John Barnes Co., Rockford, Ill. The machine is rated as a 20-in. production drilling machine and is shown in the accompanying illustration.

A straight-line drive is incorporated in the design and provision is made for the attachment of a direct-connected motor drive. A right-angle drive from either motor or countershaft can also be used, together with a tapping attachment. Eight mechanical changes of spindle speed are available, ranging from 72 to 500 r.p.m. The feed changes number twenty-four and range from 0.010 to 0.231 in. per revolution of the spindle. Eight of the feed changes are provided with the machine and special pick-off gears can be furnished to give any of the 24 feeds needed to meet the requirements of the work to be done.



*W. F. & John Barnes Co. 20-In. Production Drilling Machine*

The accompanying illustration shows one of the machines equipped with tight and loose pulleys for driving by belt from a countershaft. A suitable belt shifter is operated by a convenient handle at the front of the machine and a strong cast-iron guard for the pulleys is provided.

The main drive is contained in the column of the machine, and consists of heat-treated alloy-steel gears mounted on multiple-splined shafts that run in bronze bearings. The column forms an oil-tight compartment so that the driving mechanism can be well lubricated. The spindle is driven through a pair of bevel gears from the main gear train, the spindle driving gear being located directly above the main bearing. Four splines transmit the power of the driving gear to the spindle, so that the troubles due to loose keys are eliminated. Means are provided by which the spindle driving pinion and gear can be kept in proper adjustment.

From the top shaft in the speed transmission power is transmitted to the feed mechanism by means of a heat-treated alloy-steel helical gear meshing with a bronze gear. A pair of sliding gears is housed in the column at the right side of the head. These gears are shifted by a lever conveniently located at the front of the head, and from them a shaft runs through to a pair of pick-off change gears at the left-hand side. The twenty-four changes of feed are obtained by means of the sliding gears and the pick-off gears.

From the pick-off gears a shaft carries power to the feed worm and wormwheel at the right side of the column. A spirally grooved disk attached to the cross shaft carries a stop that may be set to trip the feed automatically at any desired point. A heavy spiral spring is employed to counterbalance the spindle and can be set to automatically return the spindle to the starting point after the feed has been disengaged.

The table elevating screw is mounted against the column of the machine to reduce the length of the lever arm from the table bearing on the column to the screw. It is stated that this arrangement reduces the tendency of the table to spring the base of the machine. A coolant reservoir is located in the base of the column and suitable pump and piping is provided to distribute the liquid on the tool and work.

The machine has sufficient capacity to drive a 1½-in. high-speed drill in steel. The design provides for the arrangement of machines in gangs up to six spindles.

# Cochrane-Bly No. 66 High-Speed Cold Saw

A recent addition to the line of equipment manufactured by the Cochrane-Bly Co., Rochester, N. Y., is the No. 66 high-speed cold saw shown in the accompanying illustrations. As an insurance against vibration and chatter the machine is provided with a saw arbor 5 in. in diameter, hardened and ground and fitted into a solid bearing.

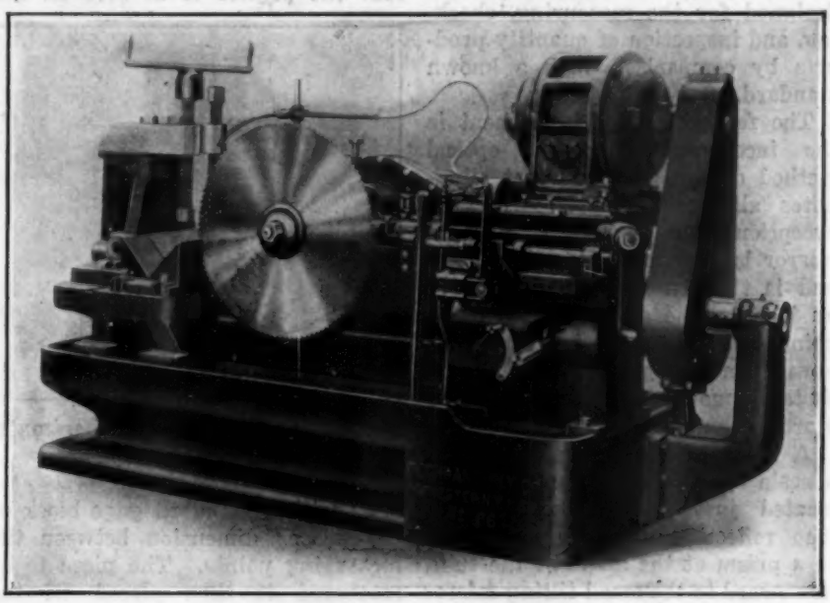


*Fig. 1—Cochrane-Bly No. 66 High-Speed Cold Saw*

The carriage casting fits around the ways and is furnished with full-length taper gibs. There is no bolted joint in the arbor bearing or the carriage bearing on the ways. The arbor is provided with a brake to absorb lost motion in the driving gears and to eliminate gear chatter and pounding of the saw teeth when cutting angles, tubing or other light sections in which only one tooth is in action at one time.

The machine will handle 10-in. round bars, 9-in. square bars, and 12-in. I-beams. The blade of the saw is 28 in. in diameter and ¼ in. thick. The feeds are geared and positive and the feed screw is mounted in line with the saw arbor, the center line of the screw being placed as close as possible to the line of the saw blade.

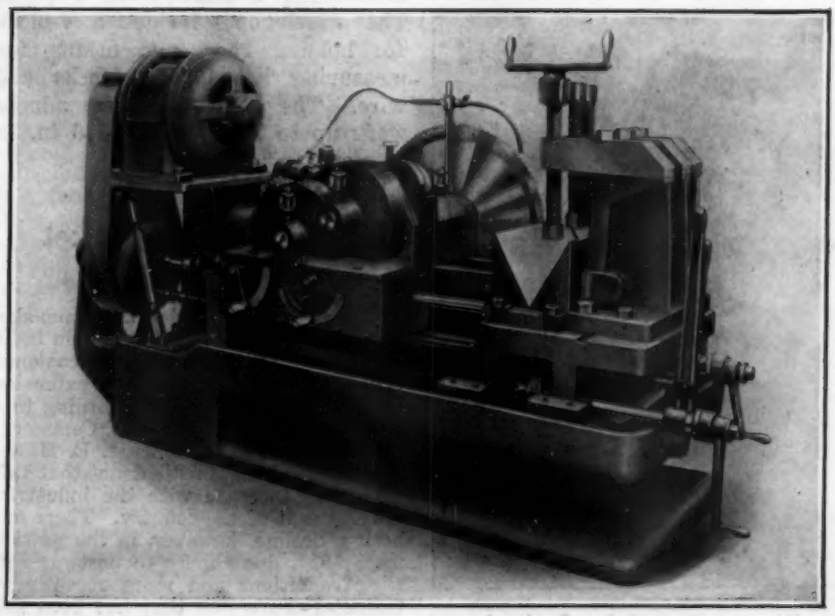


*Fig. 2—Rear view of Cochrane-Bly cold saw*

The feeds are obtained through a sliding gear and tumbler, and range from ½ to 2½ in. per minute with 11 changes. An automatic quick return for the carriage is provided, together with safety limit stops and trip stops adjustable for the entire range of the carriage travel. The controls of the machine can be operated either from the front or the rear of the machine.

A friction clutch is a part of the driving mechanism and is used for starting and stopping the machine. The driving gears are all enclosed in the saw carriage and run in a bath of oil. The hardened steel worm for driving the saw meshes with a phosphor-bronze wormwheel and its thrust is taken by a large ball thrust bearing. Sliding gears on the worm shaft give cutting speeds of 30, 40 and 50 ft. per min. The wormwheel shaft, the intermediate shaft and pinions, and all spur drive gears are made of nickel steel and hardened.

A rear view of the machine is given in Fig. 2. The double-screw vise, Fig. 1, is standard equipment, but the machine can be furnished with a 60-deg. V-block and three-screw vise for multiple cutting of small round bars. A hand-operated stock-feeding device that automatically feeds the bar and measures the length of the pieces to be cut is also furnished.

The motor drives the machine through a silent chain and sprockets, the mechanism being fully enclosed. A 15-hp. motor running at 900 r.p.m. is required. A belt driving arrangement is also available. The floor space necessary for the machine with either drive arrangement is 40x104 in., and the net weight is 7,000 pounds.

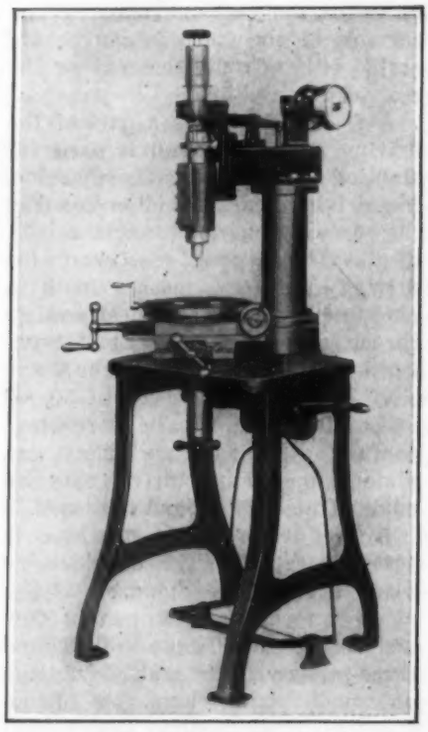
## Stark Routing Machine

The routing machine recently placed on the market by the Stark Tool Co., Waltham, Mass., is a high-speed, sensitive tool designed to produce the most intricate work. The machine is shown in the accompanying illustration as arranged for motor driving. It can also be supplied with a belt drive.

The spindle head is adjustable and is raised and lowered quickly by means of a treadle. The vertical adjustment of the spindle is 1¼ in. The depth of cut is controlled by an adjustable stop-screw located at the front of the spindle head. The spin-

dle is hardened, ground and lapped, and is mounted in adjustable alloy boxes. It is said that the spindle will operate at all speeds up to 9,000 r.p.m. without objectionable vibration.

The table has two slides located at right angles to each other and operated by feed screws. The screws



*Stark Routing Machine*

advance the slides through $\frac{1}{4}$ in. at each turn and run in split bronze nuts that automatically compensate for the wear. A 10-in. rotary table fitted with vise jaws is mounted on the upper slide for holding the work. The table is rotated by means of a worm and may be clamped in any position. The position of the table may also be adjusted vertically through a distance of $3\frac{1}{2}$ in., the greatest distance from the table top to the spindle being 5 inches.

The vise jaws open $7\frac{1}{2}$ in. and the travel of the slides is $7\frac{3}{4}$ in. From the center of the spindle to the column, the distance is 11 in. The floor space required is 30x36 in. and the net weight is 530 lb. The machine is especially adapted for die work and high-speed vertical milling work. The table and slides may be swung to bring the feed handles into the most convenient position for the operator.

A draw bar, three spring collets and a 16-in. motor pulley are included as regular equipment. A $\frac{3}{4}$-hp. motor running at 1,200 r.p.m. can be supplied.

## Carl Zeiss Optimeter

A precision measuring machine manufactured by the Zeiss Optical Works, Jena, Germany, is now being marketed in this country by George Scherr, 143 Liberty St., New York, N. Y. The device is known as the "optimeter" and is shown in the accompanying illustrations. It is designed for the measuring, checking, and inspection of quantity products by comparison with a known standard.

The feature of the instrument is the incorporation of an optical method of measurement that eliminates all moving parts, with the exception of a small mirror. The mirror is mounted on two steel balls and is tilted a few thousandths of an inch by the action of the feeler point. The entire optical system is housed in a right-angle tube, adjustably mounted in an arm on a sturdy column.

A beam of light is reflected into a scale by means of a small mirror located just behind the eyepiece. The reflection of the scale passes to a prism at the angle of the tube, downward to the small tilting mirror near the bottom of the tube, and then back through the same system to the eyepiece. As the mirror is tilted the image of the scale moves vertically in front of the eye of the observer and the amount of the movement can be read by reference to a stationary index line.

The smallest division on the scale is 0.00005 in. and readings to 0.00001 in. can be estimated. The construction of the optimeter tube is rugged

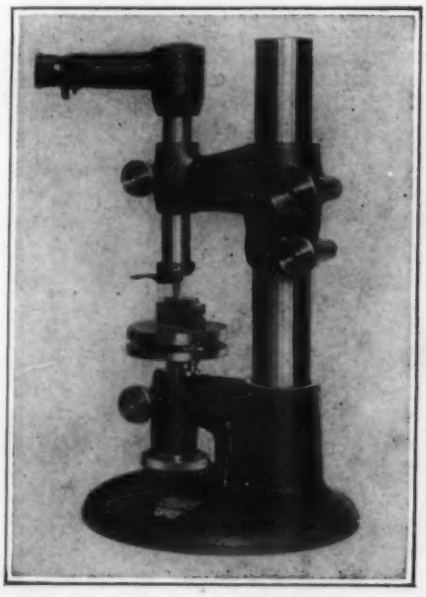


*Fig. 1—Carl Zeiss Optimeter*

and its period of usefulness should be long on account of the absence of parts that are liable to wear. The use of the optical measuring system also eliminates high measuring pressure on the work and tends toward accuracy.

The table of the instrument is adjustable vertically and is set so that the pointer is at zero on the

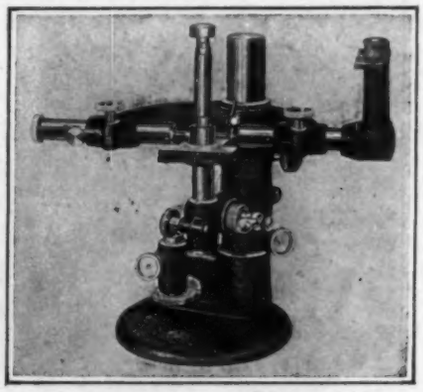


*Fig. 2—Optimeter with horizontal measuring attachment*

scale with a standard gage block of the proper dimension between the measuring points. The piece to be measured is then placed on the table between the measuring points and its variation from the standard is shown directly by the reading on the scale. The scale is of sufficient length to record a variation of 0.0035 plus or minus from the standard.

A number of arrangements for holding different kinds of work are available. Fig. 2 shows an arrangement by which the instrument is adapted for pieces that cannot be accurately measured on the vertical instrument illustrated in Fig. 1. The attachments include a V-block for holding rods, and means for measuring balls, gage blocks and wire. The standard device admits work up to 7 in. long and 6 in. in diameter.

## India Is Good Market for Machine Tools

There has been a decided expansion in the market for machine tools in India since the World War, occasioned largely by development and extension in industrial enterprises, according to a report to the Department of Commerce from Trade Commissioner J. E. Miller, Calcutta. There is little doubt that this trade will increase with the industrial development of the country. There has been a decline, however, in the market from 1921, due chiefly to postwar settling conditions and more recently to financial depression that has been felt in that country.

# News of the Week

## Record Attendance at Enthusiastic Convention of Steel Treaters

### W. S. Bidle named president—Cleveland will have next year's meeting—Francis F. Lucas gets Howe Medal—Dr. Honda honored—Exhibitors well pleased

Each year, since the first meeting of the American Society for Steel Treating, held in 1919, the verdict on the conventions has been: "Better than ever." The sixth annual convention, held in Boston from Sept. 22 to 26, inclusive, was no exception, both the program and the exhibition surpassing anything that has gone before. The total attendance was estimated at 40,000.

In the advance list of exhibitors 172 companies were listed. Others took space after the program had been given to the printer, and the corrected total was around 200. The floor space covered was 150,000 sq.ft., of which more than 25,000 ft. was covered by machine tools in operation, small tools and cutting tools, placed on display by 75 exhibitors. It is estimated that the value of the exhibits was a million dollars.

Before the convention opened there was some discussion as to the effect on the attendance at the machine tool exhibits of holding them so soon after the New Haven exhibit. However, with the exception of the opening day, all exhibits were well attended, even crowded. The exhibitors expressed themselves as well pleased by the volume of attendance and the quantities of inquiries likely to turn into sales. There were reports of a number of sales on the floor.

#### Optimism Prevalent

Among the factors affecting the success of the exhibition were the spirit of business optimism that prevailed, the fact that the machines, furnaces and so on were in operation, and the quality of the papers presented. While the factors of optimism and good papers cannot be overlooked, the most important factor was the availability of ample power and floor space, permitting operation of machines.

From the machine tool, cutting tool and small tool point of view, Commonwealth Pier was ideal for the exhibition. There is only one floor and it was so arranged that practically all of the exhibits of machine tools were in one room. The natural light was good, but in addition mercury-arc lights were burned day and evening. On a rectangular room divided into bays by well defined aisles, there was no cause for complaint in regard to position, and none was heard.

The exhibits were highly instructive even to those constantly engaged in observation of developments and must have been revelatious to men who get about one opportunity per year to leave their desks, machines or furnaces to journey into the other man's domain. Examples pointing out savings that a man could effect in his own shop were legion, and a big step must have been made in selling the idea that if equipment is obsolete, it is too expensive.

#### Convention Successful

The success of the convention and exhibition from the steel-treater's point of view and from that of the makers of equipment for the steel-treater was marked. The variety and completeness of the exhibits bore witness to the truth of this statement. They included steel and steel products, alloys, welding and cutting equipment, gas appliances, all types of furnaces, insulating materials, fire brick, rock products, instruments for measuring, testing and recording, salts, washing machines, compounds, heat-enduring materials, lights, burners, castings, automatic furnace controls, cleaning materials, speed transformers, pots, retorts, conveyor chains, forgings, belting, dies, lubricating systems, portable elevators and stackers, gears, testing machines, sand-blast equipment, air compressors, cutlery and others.

That the A.S.S.T. has constantly been improving in the eyes of the professional and technical world, internationally as well as in this country, was evidenced by the presence at the meetings of such men as Dr. Kotaro Houda, director of the Department of Metallurgical Science at the Imperial University, Tokyo, Japan, and his associate, Dr. Toyato Ishigaki, Dr. George Bulle and Dr. Herman Bleibtreu, representing the German Iron and Steel Institute, Dr. Edward Schmidt of the Limited Co., formerly the Skoda Works, Czechoslovakia, and William H. Patchell, president of the Institution of Mechanical Engineers, London.

The convention was formally opened by addresses of welcome by a representative of Mayor-Curley of Boston, V. O. Homerberg of the Boston Chapter, and A. O. Fulton, general chairman. Dr. George K. Burgess, president of the society, and director of the Bureau of Standards, responded. Dr. Burgess pointed out how the necessity created by the war for invention and for development of known products and commodities has resulted in a wonderful period of progress and how the influence of the period is to make its impression on the world markets with the return of normality and stability. Dr. Burgess also presided at several of the technical sessions.

There was presented during the convention a report from the Bureau of Standards on quenching media for heat-treatment. It relates to "quenching diagrams" for carbon steels, in which are shown the relations between Rockwell hardness, microstructure, thermal transformations and the cooling velocity at 720 deg. C. A discussion was given of the general relations between these quenching diagrams and various coolants such as water at different temperatures, oils, sulphuric acid solutions of various concentrations, brines and sodium hydroxide solutions.

The many papers presented were indicative of the accomplishments that have been made in the science of steel treating during the past year, of discoveries that are yet to be made, and of the position that the future holds for the A.S.S.T. Some of them will appear in full or in abstract form in the *American Machinist*.

#### Bidle Is New President

W. S. Bidle, president of the W. S. Bidle Co., Cleveland, was named president and W. H. Eisenman secretary. Directors for two years to fill vacancies were F. E. McCleary of Dodge Brothers, and F. P. Hughes, vice-president of the New Departure Co., Bristol, Conn. P. D. Merica of the International Nickel Co. was elected a director for one year. It was decided to hold next year's exposition in the Public Auditorium, Cleveland, Sept. 15 to 18.

The Boston chapter of the society is to be congratulated on its splendid program of entertainment, which included a smoker, visits to the plant of Thomas G. Plant, shoe manufacturer, Massachusetts Institute of Technology, General Electric Co., Lynn, Naumkeag Manufacturing Co., Salem, and the Charlestown Navy Yard. and well-balanced entertainment for the ladies. The

annual banquet and dinner dance held Thursday evening, was well attended.

The annual banquet and dinner dance at the Copley-Plaza held Thursday evening was well attended. The events of the evening included the presentation of the Howe medal for the best paper presented to the society in the past 12 months, to Francis F. Lucas, engineer of the Western Electric Co. of New York.

The medal is given in memory of Prof. Henry Marion Howe of Columbia University, and this is the second time that it has been awarded. Mr. Lucas's paper was printed in the transactions of the society, in the number just issued prior to the present convention. In connection with it he made photographs of the microstructure of magnetized steel, magnified 5,600 times.

To the small list of honorary members of the society was added the name of Dr. Kotora Honda of the Imperial Japanese University at Sendi, Japan. He is acknowledged as one of the world's most eminent metallurgists and his papers have been the subjects of highly interesting discussion at sessions of this convention. He was one of the distinguished guests from abroad present at the banquet.

Dr. George W. Burgess who was master of ceremonies, presented the president's medal to his predecessor in office, Past President T. D. Lynch of Pittsburgh, research engineer of the Westinghouse Electrical & Manufacturing Co.

S. M. Havens of Harvey, Ill., general manager for Wyman-Gordon, was toastmaster. Secretary of the Commonwealth Frederic W. Cook conveyed the greetings of the commonwealth in the absence of Gov. Cox, and Corporation Counsel E. Mark Sullivan spoke for the city. All the recipients of honors responded in brief addresses and Mr. Patchell gave a short talk that was received with hearty applause and caused the final speaker of the evening, Strickland Gillian, of Baltimore, humorist, to revise the popular saying about the English sense of humor.

# Many Machine Tool Exhibitors

Among the exhibitors whose products are of particular interest to the machinery industries were these:

Abrasive Machine Tool Co., East Providence, R. I.; in attendance: Norman D. MacLeod, C. Gordon MacLeod, Kenneth B. B. MacLeod and Harry H. Flint; Acme Machine Tool Co., Cincinnati; in attendance: Charles Meier, A. T. Stehn, and Carl Linden; Air Reduction Sales Co., New York City; in attendance: L. Edwards, J. A. Shand, P. Wilder, G. Jaeger and G. Van Alstyne; Chas. G. Allen Co., Barre, Mass.; in attendance: Harding Allen; American Gas Furnace Co., Elizabeth, N. J.; in attendance: Gustav Schwab, Theodore Farwick, Sr., John Mehrman, Theodore Farwick, Jr., Edward D. Knapp, S. P. Rockwell, W. D. Fuller and P. C. Osterman; American Metallurgical Corp., Boston; in attendance: K. A. Juthe, Albert J. Hanson, Stanley N. Juthe, Arthur C. Wright and William Walker; American Stainless Steel Co., Pittsburgh; in attendance: John C. Neale and C. S. Bunting; American Tool Works, Cincinnati; in attendance: H. W. Schatz and F. L. Stubenroth; American Twist Drill & Tool Co., Detroit; in attendance: C. G. Munn and S. Sowder; Armstrong-Blum Manufacturing Co., Chicago; in attendance: Harry J. Blum; E. C. Atkins & Co., Inc., Indianapolis; in attendance: Edward S. Norvel, J. I. Kipp, R. P. Smith and W. R. Chapin; Avey Drilling Machine Co., Cincinnati; in attendance: J. G. Hey, J. F. Mirrieless and L. H. Pratt; Baker Brothers, Inc., Toledo, Ohio; in attendance: W. W. Elliott, H. L. Tigges and Wm. Baker; Barber-Colman Co., Rockford, Ill.; in attendance: F. G. Hoffman, C. M. Cheadle, Jr., E. F. Linderoth and F. L. Peabody; John Bath & Co., Inc., Worcester, Mass.; in attendance: John Bath, Chester Bath and Robert E. Lamb; Bausch & Lomb Optical Co., Rochester, N. Y.; in attendance: I. L. Nixon, W. L. Patterson and E. H. Anthes; Bay State Tap & Die Co., Mansfield, Mass.; in attendance: Fred W. Day; Bellis Heat Treating Co., New Haven, Conn.; in attendance: A. E. Bellis, J. W. Black, G. W. Webster, J. M. Dunlevy, G. C. Davis, C. B. Kennedye, and R. C. Jordan; G. S. Blakeslee Co., Chicago; Blanchard Machine Co., Cambridge. Mass.; in attendance: F. E. Bartley and H. F. Skillings; Bristol Co., Waterbury, Conn.; in attendance: H. L. Griggs and L. G. Bean; Brown & Sharpe Manufacturing Co., Providence, R. I.; in attendance: A. E. Mandeville and J. G. Swinburne; Brown Instrument Co., Philadelphia; R. P. Brown, G. W. Keller, J. D. Andrews, G. P. Beck, C. L. Simon, G. G. Goodman, G. J. Egbert and W. S. Koop; Brown Lynch Scott Co., Monmouth, Ill.; in attendance: J. A. Scott and J. D. Tracey.

Calorizing Co., Pittsburgh; in attendance: J. A. Wilson, A. V. Farr, William M. Smith and George M. Davis; A. C. Campbell Co., Inc., Bridgeport, Conn.; in attendance: Stuart Naramore; Carborundum Co., Perth Amboy, N. J.; in attendance: J. C. Rice, J. A. King, C. E. Hawke and S. A. Fenno; Case Hardening Service Co., Cleveland; in attendance: W. C. Bell, E. J. Gossett and J. S. Ayling; Cincinnati Bickford Tool Co., Cincinnati; S. K. Wallace, L. D. Quackenbush, William F. McCarthy, H. A. Prentiss, D. F. Shaw, J. F. McCarthy and E. D. Crockett; Cincinnati Grinder Co., Cincinnati; in attendance: J. H. Peckham; Cincinnati Milling Milling Machine Co., Cincinnati; in attendance: R. L. Morrissey, J. H. Peckham, A. C. Hoefinghoff and W. W. Tangeman; Cincinnati Planer Co.; in attendance: Carl Linden and George Langen; Cleveland Twist Drill Co., Cleveland; in attendance: H. O. Swan, Fred Hoelzle, Tom Skove, W. C. Weidig, F. A. Kelly and H. P. Jenson; Cochran-Bly Co., Rochester, N. Y.: in attendance: W. H. Welch and S. M. Crandall; Crescent Washing Machine Co., New Rochelle, N. Y.; in attendance: C. S. Tompkins and E. C. Arndts; Henry Disston & Sons, Inc., Philadelphia; in attendance: Joseph L. Dorrington and Edward P. Ludy; Driver-Harris Co., Harrison, N. J.; in attendance: G. A. Lennox, J. B. Shelby, W. B. Blythe, H. D. McKinney, Arlington Bensel, G. A. Rickert and H. O. Hartdegan; Dycast Steel Co., Collinsville, Conn.; in attendance: A. C. Davidson; Eaton Electric Furnace Co., Taunton, Mass.; in attendance: H. B. Eaton, Murray Winter and A. A. Harvey; Federal Machine & Welder Co., Warren, Ohio; in attendance: F. P. McBerty, Z. A. McBerty, A. V. B. Cutler and Albert E. Hackett; Firth-Sterling Steel Co., McKeesport, Pa.; in attendance: E. E. Roberts, Al Mattson, O. T. Smith, J. F. Higgins, H. I. Moore, F. Miller, A. E. Barker, E. T. Jackman, R. F. Kimber, A. C. Leete and D. G. Clark; Fitchburg Machine Works, Fitchburg, Mass.; in attendance: E. R. Smith; William Ganschow Co., Chicago; in attendance: A. F. Boissoneau; General Alloy Co., Boston; in attendance: H. H. Harris, E. P. Van Stone, W. K. Leach, A. L. Grinell, A. D. Heath, J. J. Donovan and L. J. McCarty; General Electric Co., Schenectady, N. Y.; in attendance: D. G. Brokaw, L. A. McKenney, L. C. Rossear, J. F. McFarlane, C. L. Ipsen, A. N. Otis, E. F. Collins, W. A. Gluesing and L. W. Shugg; General Furnace Co., Philadelphia; in attendance: Horace Drever, Frank Hodson and G. C. Garland; Geometric Tool Co., New Haven, Conn.; in attendance: G. A. Denison, G. T. Case, F. W. Case, F. W. Gowrie, J. E. Bullock, E. L. Wood and F. A. Barker; Gisholt Machine Co., Madison, Wis.; in attendance: E. S. Chapman, F. M. Nelson, Z. E. Thomas, and R. D. Heflin; Goddard and Goddard Co., Detroit, in attendance: A. N. Goddard, C. H. Wallace, and Dix Proctor; Goss and DeLeeuw Machine Co., New Haven, Conn.; in attendance; E. H. P. Peck, J. J. Spring and S. T. Goss; Gould and Eberhardt, Inc., Newark, N. J.; in attendance: A. Miller, H. W. Jacobson and F. G. Eberhardt; General Welding & Equipment Co., Boston; in attendance: Dr. A. Krebs, Thomas F. Stoddard, Daniel A. Lee, Carlos Krebs, M. M. Krebs.

George J. Hagen Co., Pittsburgh, in attendance: J. E. Randall, P. A. Meyer, G. T. Thatcher, R. E. Talley, C. F. Cone, R. L. Corbett and A. D. Dauch; C. I. Hayes. Providence, R. I.; in attendance: C. L. Hayes, J. E. Hines and A. E. Bernier; Heald Machine Co., Worcester, Mass.; in attendance: R. A. Heald and Robert M. Lippard; Heim Grinder Co., Danbury, Conn.; in attendance: Robert Krametz; Hendey Machine Co., Torrington, Conn.; in attendance: A. H. Hall and E. W. Bersler; Heppenstall Forge and Knife Co., Pittsburgh; in attendance: C. W. Heppenstall, A. J. Porter, Jr., C. J. Sauer, H. P. Jones, A. L. Wurster and Floyd Rose; High Speed Hammer Co., Rochester, N. Y.; in attendance: E. F. Meyering, H. A. Moore and H. C. Levine; Hoskins Manufacturing Co., Detroit; in attendance: Charles S. Kinnison, G. L. Price, W. D. Little and W. A. Gatward; E. F. Houghton and Co., Philadelphia; in attendance: R. K. Gurney, R. F. Smith, W. A. Buechner, H. E. Cressman and J. Coleman Bentley; Hunter Saw and Machine Co., Pittsburgh; in attendance: H. S. Hunter, F. A. Hunter and Carl Schnubel; International Nickel Co., New York City; in attendance: Dr. P. D. Merica, Charles McKnight, Jr., T. H.

Wickenden and L. Muller-Thym; Jones and Lamson Machine Co., Springfield. Vt.; in attendance: H. S. Beal, B. L. Billings, and J. L. Lovely; Keller Mechanical Engineering Corp., Brooklyn, N. Y.; in attendance: S. A. Keller, Jules Dierckx, Henry Schreiber, Charles A. Mertens, M. Mayer and C. J. Priebe; Kobert Machine Co., Wooster, Ohio; in attendance: F. C. Kobert; Leeds and Northrup Co., Philadelphia; in attendance: Henry Brewer, G. W. Tall, Jr., E. B. Estabrook, Oscar Brewer, T. C. Smith, W. A. Lane, Jordan Korp, J. W. Harsch, H. N. MacMichael, E. H. Carlson and P. H. Taylor; Lewis-Shepard Co., Boston; in attendance: G. E. Squier; Lodge and Shipley Machine Tool Co., Cincinnati; in attendance: Fred Albrecht and Earl M. Wagner; Lynd-Farquhar, Boston; in attendance: E. D. Crockett, B. H. Shaw, James E. McCarthy, H. A. Prentiss; Moline Tool Co., Moline, Ill.; in attendance: W. P. Hunt and H. D. Gentry; Monarch Machine Tool Co., Sydney, Ohio; in attendance: W. E. Whipp; Morse Twist Drill & Machine Co., New Bedford, Mass.; in attendance: W. T. Read.

National Automatic Tool Co., Richmond, Ind.; in attendance: F. D. Shriver, H. A. Fuller and E. D. Frank; National Twist Drill and Tool Co., Detroit; in attendance: H. Butler; New Britain Machine Co., New Britain, Conn., in attendance: H. H. Pease, R. S. Brown, E. L. Steinle, R. T. Frisbie, Arno Schubert, F. R. Downs, C. A. Doherty and R. Hulbert; Norton Co., Worcester, Mass.; in attendance: C. W. Saxe, Robert Kirkpatrick, R. P. Capron and J. S. Rose; R. D. Nuttall Co., Pittsburgh; in attendance: R. F. Fiske, J. E. Mullen and W. H. Philips, Ohio Machine Tool Co., Kenton, Ohio; in attendance: C. C. Swift and L. H. Peters; O. K. Tool Co., Shelton, Conn.; in attendance: G. W. Conklin, Frederick Schroeder and H. L. Taylor; Olsen Testing Machine Co., Tinius, Philadelphia; in attendance: R. B. Lewis and T. Y. Olsen; Oxweld Acetlyene Co., New York City; in attendance: Sidney Wade; Pangborn Corp., Hagerstown, Md., in attendance: T. W. Pangborn, H. D. Gates, G. A. Cooley, C. T. Bird, G. H. Kahn and H. M. Ream; Peerless Machine Co., Racine, Wis.; in attendance: A. H. Goetz and I. M. Ward; Pennsylvania Pump and Compressor Co., Easton, Pa.; in attendance: G. S. Githens; Potter and Johnston Machine Co., Pawtucket, R. I.; in attendance: Norman R. Earle; Pratt and Whitney Co., Hartford, Conn.; in attendance: Marcus Chase, T. Boyd, M. S. Bradley, A. H. d'Arcambal, A. E. R. Turner; Prentiss Co., New York City; in attendance: W. F. McCarthy; Racine Tool and Machine Co., Racine, Wis.; in attendance: J. M. Jones and William C. Reinhardt; Rivett Lathe and Grinder Corp., Boston; in attendance: E. P. MacCannell and A. L. Hathorne; Rockford Milling Machine Co., Rockford, Ill.; in attendance: D. B. Burleigh; W. S. Rockwell Co., New York City; in attendance: J. N. Voltmann and C. D. Barnhart; F. J. Ryan and Co., Philadelphia; in attendance: F. J. Ryan, G. F. Beach, F. A. Hall, T. B. Bechtel, G. R. Coats and E. L. Willson.

Seneca Falls Machine Co., Seneca Falls, N. Y.; in attendance: E. R. Smith; Shore Instrument Co., Jamaica, N. Y.; in attendance: F. G. Kendall; Simonds Saw and Steel Co., Fitchburg, Mass.; in attendance: H. B. McDonald, C. R. Paffenbach and C. W. McKay; Skinner Chuck Co., New Britain. Conn.; in attendance: P. K. Rogers; Sly Manufacturing Co., Cleveland; in attendance: F. A. Ebeling, D. L. Harris and D. C. Gilchrist; Spencer Turbine Co., Hartford, Conn.; in attendance: S. E. Phillips, H. M. Grossman and O. J. Dingee; Surface Combustion Co., New York City; in attendance: F. J. Evans, C. B. Philips, C. H. Cummings and M. K. Epstein; Thomson Electric Welding Co., Lynn, Mass.; in attendance: M. G. Littlefield, L. S. Taylor and R. M. Taylor Henry G. Thompson and Son Co., New Haven, Conn.; in attendance: Thomas A. Hyde and William Neville; Union Twist Drill Co., Athol, Mass.; in attendance: J. H. Horigan, J. W. Rathbun, G. F. Holland, W. E. Horsefield and L. H. Lathe; V and O Press Co.. Hudson, N. Y.; in attendance: F. M. Ironside; Walcott Lathe Co., Jackson, Mich.; in attendance: D. G. Kimball, C. S. Sylvester; O. S. Walker Co., Worcester, Mass.; in attendance: Lawrence G. Drury; Warner and Swasey Co., Cleveland; in attendance: E. R. Gardner, J. A. Craig, and C. J. Stilwell; Westinghouse Electric & Manufacturing Co., East Pittsburgh; in attendance: W. S. Scott, A. T. Ruttencutter. R. M. Keany and P. H. Grunnagle; Whitehead Metal Products Co., New York City; in attendance: William M. Bastable. R. F. Blessington, T. M. Bohen, E. W. Silver and S. Marks; Wilmarth and Morman Co., Grand Rapids, Mich.; in attendance: Arthur Williams; Wilson-Maeulen Co., New York City; in attendance: J. E. Heckel.

## Want Ruling on Trade Associations

In an effort to secure an official ruling to clearly define the legal rights of trade associations in collecting and distributing statistics and other activities, a committee representing the Chamber of Commerce of the United States visited Attorney General Stone, Secretary of Commerce Hoover, and members of the Federal Trade Commission in Washington, Sept. 22.

The results of a referendum undertaken by the national chamber last year on trade association functions, together with supporting and explanatory data, were laid before the Federal officials. No effort was made to secure an expression of opinion from the officials at the meetings Sept. 22, but they were asked to study the data presented then and to meet the chamber's committee again late in October, at which time it is hoped by the committee that there may be obtained an opinion that may be made public.

Each of eight proposals defining in rather general terms the proper scope of trade association functions laid before its membership by the Chamber of Commerce of the United States last year was given overwhelming approval, and thus these propositions became the policy of the national organization.

According to Richard F. Grant, of Cleveland, newly-elected president of the Chamber of Commerce of the United States, it is the belief of officials of that organization that a trade association functioning along the lines laid down in the chamber's policy is clearly within the law. So much has been said recently, however, regarding the "twilight zone" of association activities in regard to the Sherman anti-trust law, and there being no clear-cut judicial decision marking the line between legal and illegal activities, that conferences with the Federal officials were sought in order to obtain, if possible, an official opinion which would form the basis of procedure.

If such an opinion is not obtained at the conference to be held in October, it is expected that the national chamber will proceed to draft suggested legislation for Congress.

President Grant of the national chamber appears to think that it will be possible to secure an opinion upon which trade associations may act. Attorney General Stone previously, however, had declined to give such an opinion because of the broad lines involved.

## Tribute to McCarthy and Prentiss Co.

At the Steel Treaters' convention in Boston, last week, the representatives of the manufacturers represented by the Henry Prentiss Co. tendered a written appreciation to the company and to W. F. McCarthy on account of their work in the successful presentation of the exhibits. The testimonial was presented at a dinner held at the Engineers' Club. It bore the following signatures:

Keller Mechanical Engineering Corp.: Jules Dierckx, Henry Schrieber, Charles A. Mertens.

O. S. Walker Co.: L. G. Drury, C. O. Smith.

V. & O. Press Co: F. M. Ironside, F. A. Beardsley, H. F. Zorn.

Baker Bros.: W. W. Elliott, W. Baker.

Blanchard Machine Tool Co.: F. E. Bartley, H. F. Skillings, Henry K. Spencer.

Avey Drilling Machine Co.: L. H. Pratt.

Gould & Eberhardt: Albert Miller, Frederick G. Eberhardt.

Acme Machine Tool Co.: Charles Meier, A. T. Stehn, Carl E. Linden.

Cincinnati Planer Co.: Carl E. Linden, Geo. J. La Mont.

Cincinnati-Bickford Machine Tool Co.: S. K. Wallace, L. D. Quackenbush.

Cincinnati Milling Machine Co.: R. L. Morrissey, J. H. Peckham.

Moline Tool Co.: H. D. Gentry.

Henry G. Thompson & Sons Co.: Thos. A. Hyde.

Lodge & Shipley Machine Tool Co.: Fred Albrecht, E. M. Wagner.

Goss & De Leeuw: Stanley T. Goss, J. J. Spring.

Henry Prentiss Co.: R. W. Phelps.

Giddings & Lewis Machine Tool Co.: W. M. Edes, H. J. Glassel.

National Automatic Tool Co.: F. D. Shriver, H. A. Fuller, Edw. D. Frank.

Robert Machine Co.: J. Whitney, Jr., J. Peterson.

Cincinnati Grinder Co.: E. L. Pelle.

# The Business Barometer

## *This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments*

**By Theodore H. Price**
Editor, *Commerce and Finance*, New York

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AS ELECTION day approaches it becomes impossible to study business without considering politics. Straw votes are being taken all over the country. Those that have attracted most attention in Wall Street have been gathered by the *Literary Digest*, the New York *American* and the New York *World*. They agree in giving Coolidge a large plurality. LaFollette is running second and Davis a poor third.

A few highly speculative securities have been marked up, but most of them belong in what is called the "personally conducted" group. Public interest has been lacking except in some railroad stocks that have responded to the talk of a consolidation of the less important systems west of the Mississippi Valley.

Cotton has also been feverishly active at an advance of about three cents a pound, due to a government report that indicated a decrease instead of the expected increase in the prospective yield, but the effect of the rise has been increased dullness in the market for cotton goods. No one knows the facts, but the wish is father to the thought in the dry goods trade, where the belief in a sufficient crop continues to persist.

Except for these few articles the markets are lower. At the spring opening of the American Woolen Co. last year's prices were cut an average of probably 10 per cent. The United States is now importing quite a little corn from the Argentine and the opinion grows that all cereals are about as high as they are likely to go.

Steel is slightly lower. The trade authorities attribute the decline to the "disturbance" following the abandonment of the "Pittsburgh plus" schedules, but the explanation is not satisfying. Copper is back to 13 cents, although the salesmen of the copper companies are still holding up the *ignis factus* of an increased demand later on. The other metals have not changed much but a speculative group in London continues to play battledore and shuttlecock with tin.

Lumber and cement are the only building materials that are not lower. The former is supported by the rural demand and the latter by the powerful producing companies who never permit an oversupply to come on the market.

But it is evident that the extraordinary building activity of the last few years is now drawing to a close. It is estimated that the American habit of moving on Oct. 1 costs the nation $100,000,000 a year, but there is less of it than usual this year because landlords have been willing to make concessions to keep tenants. The result is that many of the recently constructed apartments in New York and elsewhere are but partially filled and, although it is denied, those who are "in the know" admit that the rental market is easier.

At the Investment Bankers Convention in Cleveland a committee appointed to consider the subject made a report against the issuance of long time bonds on real estate properties, to which it added "In connection with vacancies that are bobbing up here and there in various types of buildings and various parts of the United States it is interesting to note an increasing tendency on the part of real estate owners to grant bonuses to tenants to move in. * * * This is an unmistakable indication that in sections where this practice is at all prevalent the building shortage has been largely overcome."

Another straw which shows the direction of the current in so far as building operations are concerned is a letter in the *New York Times* from the president of the Bowery Mission. He appeals for contributions to help in caring for the unemployed who apply to the Mission, and explains that "The Free Labor Bureau of the Bowery Mission is a barometer which indicates with unfailing exactness the condition of the unskilled labor market. We are having a fall and winter very much like those of three years ago. During the first week of September we had 1,642 men at our meetings and of this number we found that 1,368 had to be fed or housed or clothed."

As the labor leaders undoubtedly know of these conditions it is to be hoped they will not persist in ordering the strike that they threaten because the New England mill operatives are being put back on part time work at a reduction of from 10 to 15 per cent in wages.

The indications are that wages in many industries will have to be reduced before the winter is over. The probability of this reduction and the political uncertainty are the only two clouds that darken an otherwise satisfactory outlook. If with lower wages there comes a reduction in rents and in the cost of living otherwise no one will be worse off. The only trouble is that the readjustment causes strain and friction.

Money is again growing easier. The State of New York has sold $12,500,000 of its bonds on a 3.64 per cent basis. The impression grows that the German loan will be delayed until after our election.

There is a distinct improvement in shipping. During the last 30 days more than 150 vessels previously idle have been chartered. Of these 85 will be loaded with grain.

The Federal Reserve statement shows no significant changes. The reserve ratio is back to 80.4 per cent, but the commercial rediscounts amount to only $170,000,000 and in so far as general business is concerned the Federal Reserve Banks have ceased to be a factor.

### *What's Doing in Industry*

**Business was better in nearly all parts of the country in the machinery and machine tool trade during the past week. Railroads bought more than they had for several weeks past and general industrials were in the market to a far greater extent than for at least two months. Production also speeded up in and around Cincinnati and Milwaukee, while there have been definite signs of revival in the New England district.**

**The steel market held firm during the past week, although there was some hesitancy in buying due to the change in the rates caused by the abolition of the Pittsburgh Plus plan.**

**There has been a decided let-up in construction during the past two weeks and electrical goods are not moving with the alacrity that formerly characterized this business, although jobbers report a better feeling among consumers.**

**General business has been bettered a trifle, although there is still room for improvement which is confidently expected after this month. With the uncertainty of a national election out of the way, conditions will be steadied and probably improve.**

**Wall Street presented a puzzling picture this week. Although the volume of sales was good, prices were irregular except among some of the more staple securities. Many stocks are near the peak price for the year, especially among the rails and the motors.**

# The Industrial Review

## *Progress of the machinery and machine-tool business in various parts of the country*

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

### Philadelphia

While there has been an increase in industrial activity this month as forecast by large manufacturers and jobbers, the volume of business has not been up to the expectations of some who anticipated a real Fall revival. Manufacturers of machine tools and machinery of various sorts are disappointed. There is nothing to indicate the railroad companies expect to enter the market in the near future. The inquiries received by many of the manufacturers have not produced the orders they had hoped for.

One of the largest manufacturers of motor trucks expressed the belief that business at this time is on a firmer basis than it was a year ago. Executives of many firms have expressed greater interest in this line than was evidenced late in the summer. The inquiries are well distributed geographically.

Some dealers in used machinery report a more favorable condition now than that which obtained six weeks ago.

The building trades, which have been active most of the summer with several central business district operations completed, have given indications of less activity and a considerable let up is anticipated for the remainder of the fall.

Manufacturers of ice making machinery report the volume of sales smaller than at this time last year, due probably to uncertain weather conditions. Refrigerator manufacturers are taking a fair sized quantity of small electric machines. The South holds some prospect for a fairly active fall and winter.

### Cincinnati

There has been a decided increase in production by Cincinnati machine tool houses during the past two weeks. Reports from the larger concerns show that sales are on the upward trend and that the volume of business done during September will be considerably ahead of that during the previous month.

Executives in the machine tool industry are optimistic about the outlook for the immediate future, and they predict that the next few weeks will be the best that Cincinnati plants have enjoyed in 1924. Inquiries now on hand are larger than they have been for many months and it is thought that many sales will be made shortly.

Railroads have been placing a fair amount of business with Cincinnati machine tool companies. Several plants state that the railroads are not bickering as much about prices as they did, and that they are in the market for higher grade machinery. Lists of several roads are now out and this business is expected to be placed within a short time. Inquiries from automobile manufacturers have been brisk, but there has only been a small amount of actual orders received from them for machinery.

Both lathes and milling machines are selling better than they were several weeks ago. One large manufacturer is working full time on large orders for special machines. Inquiries for planers indicate that the market is in good shape, but sales have gone along at about the same level as during August. Conveying machinery houses are working on a normal production basis and the same is true of woodworking machinery concerns. Electrical tool manufacturers are still receiving the bulk of their business from the automotive field.

There has been a marked improvement in the used machinery market. Sales during September have been considerably larger than in August.

The metal trades report some improvement and foundries here are working on a slightly heavier schedule than they were.

### New England

Consensus of sales managers in the machine industry in the New England territory leads to the conclusion of a broadening trade in the automotive industry, much of it for expansions and a good percentage of replacement business. Railroad buying is extending, judging from orders received and increased inquiries.

Orders for automatics are being received in good volume by some of the builders. Increased working hours have been ordered in three shops of considerable size in Hartford, Conn., and increased schedules are contemplated by two other managements. These are necessary for replacement business in most cases. A comparatively new industry in the automatic field is gradually increasing its working force to meet production requirements. This buying is for new installation.

September inquiries received at different small tool plants have not been as good as in August, but were an improvement over July.

Good railroad buying is expected in October. The sales to automotive industries have held fairly satisfactory.

Special machinery building is improving but in this particular field the depression is not so seriously felt. Production for the glass industry is increasing and this is mostly for replacement.

Chuck and die trade among the leaders is quite encouraging. Improvement which began four months ago continues and September's business is variously estimated at gains from 15 to 30 per cent over August.

The indications of a big grain crop has increased trade of builders of machinery going directly or indirectly into the flour business.

That the corner has been turned is the belief of manufacturers and the next six weeks will see gradually bettering conditions.

### Cleveland

Real business for the machine tool manufacturer and distributor is at hand. September has brought the long expected demand for new equipment, and production at plants in the Cleveland district is again on the upgrade.

The principal outlet still is for the lighter weight equipment. The automotive industry is out of the market as far as any real replacement is concerned. On the other hand general manufacturing has come forward to a marked degree in the last two weeks, and the last quarter of 1924 is expected to see a significant number of deliveries in a wide variety of tools and machines.

Automatic machine orders are better in the last ten days than they have been at any time this year.

Equipment required for structural material manufacture, notably heavy duty punches and shears, is not showing the same gain in demand. This is a natural consequence of the season, however, since a curtailment in heavy building operations can be looked for from now to the end of the year. At the same time lighter building material manufacturing equipment is finding a better outlet, ostensibly to provide a quicker cleanup of business to meet the close of the smaller building operations.

### New York

Business showed further signs of improvement in the New York market and the machine tool dealers in that territory are optimistic as to the future months of the year. Notable among the purchases made during the week was a sizable one by the Bethlehem Steel Co. and the closing on a small list by the General Electric Co. The Chesapeake & Ohio R.R. has a list of approximately forty tools out, many of them of special design. The Lackawanna, the D. & H., the New York Central and the Lehigh also have lists out and will probably be ready to close on them within the next two weeks.

Japanese buying is at a standstill. Except for small tools that will be pur-

chased from time to time, it is not expected that any orders will be forthcoming until after the first of the year.

Inquiries are being received by dealers from automobile accessory plants and good sized orders are anticipated if the lists are any indication.

General industries seem to be in a better frame of mind and salesmen report that better business may be expected from this source within the next month.

Export business was reported as a trifle quiet this week with no cause given. It has been exceptionally good and a slight let down is not a source of worry for the New York exporters.

Used tools found a good market last week and sales from New York offices were reported in the lower portion of New England and also around Philadelphia.

## Detroit

Expectations on the part of executives in the machine tool and machinery lines in Detroit and its environs for business during the remaining months of 1924 are not as bright just at present as had been anticipated some weeks ago.

Some improvements in the automotive industry have been noted during the past few days. Announcement has been made that the Canadian plant of the Ford Motor Co. will resume operations upon a five-day week plan. About one-third of the force at the Ford Highland Park plant have been recalled to work Saturday morning. The gain in orders has been enough to warrant increased production, Ford officials stated.

Slight increases in the employment situation indicate further resumptions of activities by many manufacturers. Not much change is expected in the near future, those closely in touch with the industry assert.

Interest in the rapid development of the aircraft industry in Detroit has been aroused through the intimation that the Government has practically completed arrangements whereby a larger order will be placed with a local concern.

## Bridgeport Institute Opens Oct. 13

At a recent meeting of the newly formed Bridgeport Engineering Institute, W. R. Webster, vice-president of the Bridgeport Brass Co. and president of the American Tube & Stamping Co., was elected president for the coming year. A. E. Keating, plant engineer of the American Tube & Stamping Co. will be the dean of the Institute and the other members of the board elected were: Stanley Bullard, the Bullard Machine Tool Co.; Walter R. Clark, general works manager of the Bridgeport Brass Co.; and W. S. Clark, general manager of the Bridgeport plant of the General Electric Co.

The Bridgeport Engineering Institute which is endorsed by the A.S.M.E. will open up for the first time at the Bridgeport High School, Oct. 13. It will provide a four-year course of instruction in engineering subjects at a nominal cost to men of the local industries who are employed during the day.

# Business Items

The Fafnir Ball Bearing Co., New Britain, Conn., will increase its capitalization from $1,500,000 to $3,000,000 if the recommendation of its directors is adopted. The increase will be by 100 per cent stock dividend.

The surplus stock of the Willys Overland Co. is to be sold at auction by Samuel T. Freeman & Co., 1808 Chestnut St., Philadelphia.

Stockholders of the National Acme Co., Cleveland, will meet on Oct. 24 to pass on a proposal to reduce the capital stock from 25 to 5 million dollars. The total number of shares to be unchanged

The Essley Machinery Co., Chicago, is the exclusive agent in the Chicago and Milwaukee districts for the Rockford Milling Machine Co., Rockford, Ill., and the Rockford Tool Co., Rockford, Ill.

The Economy Fuse & Manufacturing Co., Chicago, Ill., announces that its Minneapolis office has been moved to 1,008 Marquette Ave., Minneapolis.

The name of Sherritt & Stoer Co., Philadelphia, Pa., has been changed to the Stoer Machinery Co. There has been no change in the personnel.

# Obituaries

THOMAS H. LEISK, aged 58 years, formerly plant superintendent of the Cudahy works of the Worthington Pump & Machinery Corp., near Milwaukee, died Sept. 22 at the home of his son in St. Louis, Mo. Illness compelled him to retire from active affairs about five years ago.

ABRAM H. BALLINGER, president of the American Foundry & Machine Co., Hamilton, Ohio, died recently in that city.

# Personals

H. L. FLATHER, treasurer of the Flather Co., Nashua, N. H.; JAMES E. GLEASON, president of the Gleason Works, Rochester, N. Y.; and WILSON P. HUNT, president of the Moline Tool Co., Moline, Ill., have been nominated as the three directors for three years of the National Machine Tool Builders' Association.

FRANK HAGEN has resigned as superintendent of the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.

J. H. KEEGAN has severed his connection with the Advance Furnace & Engineering Co., Springfield, Mass., and has been appointed manager of sales of the Economy Furnace Co., Chicopee, Mass.

JOHN D. MAURER, assistant general superintendent of the Bay View mills of the Illinois Steel Co., at Milwaukee, has been promoted to general superintendent, filling the vacancy caused by the death of Richard B. Charlton.

BENJ. H. RHYNEARSON, formerly of the Richey-Rhynearson Machinery Co., Indianapolis, Ind., is now in business for himself at 38th St. and Dearborn St., Indianapolis.

C. V. PETERSON, formerly with Hill, Clarke & Co., Inc., Boston, has rejoined that firm. His territory will be Massachusetts and Rhode Island.

JOHN DUNN, formerly superintendent of the Futrell Coupler Co., Streator, Ill., has joined the organization of the Western Glass Co., Streator, as master mechanic.

W. L. GARRISON has been appointed assistant manager of the engineering department of the Ingersoll-Rand Co., New York.

GEORGE L. MOORMAN has become manager of the Bignall & Keeler Machine Works at Edwardsville, Ill. He was formerly assistant manager.

HERBERT K. KEEVER has accepted a position with the McDonald Machine Co., Chicago.

WILLIAM SCHWANHAUSSER, chief engineer of the Worthington Pump & Machinery Corp., Newark, N. J., was guest of honor at a dinner given recently by officials of the corporation in honor of his seventieth birthday and to mark the fortieth year of his continuous service with the Worthington organization.

L. E. DE GROAT, formerly with the Acme Motor Truck Co., Detroit, has joined the Capitol Brass Co., Detroit.

L. R. WITTLOCK has been appointed vice-president and a director of the Du-All Manufacturing Co., Cleveland, succeeding E. C. Henn, deceased.

HOWARD DAVENPORT has gone to South America where he will represent the Continental Motor Corp., Detroit. His headquarters will be in Buenos Aires.

ROBERT K. MITCHELL, for nine years with the Maxwell-Chrysler Corp. of Detroit, has joined the Nordyke & Marmon Co., Indianapolis, as production superintendent.

HARRY M. ROBINS, former foreign sales manager for Dodge Brothers, has joined the Oakland Motor Car Co., as director of districts.

E. A. TRAVIS, for several years general sales manager of the Locomobile Co., has resigned to become sales executive of the Edwin M. Jennings Co., of Bridgeport, Conn.

H. J. JOYCE, JR., has charge of the newly opened Indianapolis office and warehouse of Carpenter Steel Co., Reading, Pa. The headquarters are located at 633 Fulton St.

HAROLD MATTHEWS has resigned as purchasing agent at the Service Motors, Inc., Wabash, Ind., to accept a position with the Garford Motor Truck Co., Lima, Ohio.

J. H. DOWD has joined the organization of the Billings & Spencer Co., Hartford, Conn.

WILLIAM KNIGHT has resigned his position with the Ford Motor Co. to become vice-president and general manager of the Junkers Corporation of America in New York City.

E. W. COONEY has been appointed president of the American Forge & Tool Co., Anderson, Ind.

LON R. SMITH has been appointed manager of the windshield division of the Zenite Metal Co. of Indianapolis. Mr. Smith formerly was Western representative of the Eisemann Magneto Co., sales manager of the Buda Co., and vice-president in charge of sales and advertising of the Midwest Engine Co.

ELFRIDA HARDER has opened a technical book shop at 126 East 41st St., New York City. It is known as the Engineers' Book Shop and is devoted to technical books and allied literature.

MARCUS D. MORLEY of New York City, has gone to Osaka, Japan, where he is with Mitsui Bussan Kaisha.

# Big Gains in 1924 Machinery Exports

Total United States exports of industrial machinery increased from $116,804,518 for the fiscal year ending June 30, 1923 to $133,623,733 for the fiscal year ending June 30, 1924, according to the Industrial Machinery Division of the Department of Commerce. The market for the United States industrial machinery throughout the world is still increasing according to these recent figures. Furthermore, the expansion is at a higher rate—14 per cent—than was indicated by machinery export figures for the calendar years 1922 and 1923 which increased 10 per cent.

Exports of power-generating machinery amounted to $14,854,032 for the fiscal year ending June, 1923, and $16,829,511 in 1924. The greatest increases within this classification occurred in the accessory group: Steam engine accessories and parts increased nearly a million dollars and internal combustion engine accessories over $1,500,000. These gains more than offset declines in shipments of steam engines proper. Boiler shipments showed a gain of over $600,000 in the latter fiscal year.

Exports of construction and conveying machinery to world markets for the fiscal year ending June, 1924, increased over $2,000,000 above the preceding fiscal year. The greatest gains in this classification occurred in shipments of road rollers and dredging machinery.

Exports of mining, oil-well, and pumping machinery increased from $18,591,014 for the fiscal year ending June, 1923, to $24,661,900 for the fiscal year 1924, or approximately thirty-three per cent. Exports of oil-well drilling apparatus more than doubled in the latter year; steam pump exports increased approximately forty-seven per cent. Considerable increases occurred in shipments of ore crushing and sorting and smelting and roasting machinery.

Within the metal working machinery export classification, lathes, bending and power presses, gear cutters, sharpening and grinding machines, and pneumatic portable tools showed the greatest increases. Exports of lathes were $714,785,000 during the fiscal year ending June, 1923, and $1,250,482 for 1924—an increase of nearly seventy-five per cent. Shipments of bending and power presses and gear cutters more than doubled in the latter fiscal year. Exports of rolling machines decreased by 24 per cent during the 1924 twelve-month fiscal period.

## Trade Catalogs

**Micarta.** The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. This is catalog 1,579 C. in which Micarta gears and pinions are described and illustrated. The ease of manufacturing gears and pinions with Micarta is explained and the methods for obtaining the best results are told.

**Portable Air Power.** The Ingersoll-Rand Co., 11 Broadway, New York City. "One Hundred and One Ways to Save Money with Portable Air Power," is the title of a booklet that has recently been issued by this concern. The illustrations show the machine in operation in many different places and on many widely varied jobs. The booklet is very interesting and brings forth many uses for air power drills not usually thought of.

**Automatic Station Control Equipment.** The General Electric Co., Schenectady, N. Y. A bulletin designated as No. 47,731, in which is described briefly the uses and advantages of the equipment. The greater part of the bulletin is given over to a list of installations up to Jan. 1, 1924, giving the name of the company station, type of apparatus, kilowatt capacity, and incoming and outgoing voltage.

**Single Purpose Gear Generator.** The Lees-Bradner Co., Cleveland, Ohio. Full description of the operation and performance of this product is contained in the catalog. The simplicity of operation and the durability of the machine are emphasized.

**Pulleys and Flywheels.** The Pyott Foundry Co., 328 N. Sangamon St., Chicago, Ill. The dependability of the pulleys and flywheels made by this company for more than 25 years is told in a folder recently issued. Illustrations aid the text in convincing the reader.

**Cutters and Reamers.** The H. H. Arnold Co., Inc., Rockland, Mass. The price list of the chucking reamers, shell reamers and hand reamers made by this company has been mailed out to the trade. Illustrations show the products and there is a short description with each illustration.

**Bumpers.** The C. G. Spring & Bumper Co., Detroit, Mich. A booklet containing engineering data showing the requirements of bumpers for automobiles, bumper design and efficiency, the attachments for fitting to cars, protective coatings and bumper tests.

**Resistors.** The Monitor Controller Co., Baltimore, Md. The Monitor Edgewound Resister is described and illustrated in a four-page folder recently issued.

**Gear Testing Machine.** The Societe Genevoise D'Instruments De Physique, Geneva, Switzerland. The R. Y. Ferner Co., Washington, D. C., United States representative of this Swiss concern has mailed out a catalog describing this product which is one of the high-precision tools made by the Societe Genevoise. It is in English and contains specifications and formulas.

**Ball Bearings.** The New Departure Manufacturing Co., Bristol, Conn. The use of ball bearings in electric motors is urged in this folder. Many reasons for the use are given.

**Wall Enamel.** The Hilo Varnish Corp., Brooklyn, N. Y. The advantages of light work rooms and the economy of using the product of this company in making the factory light, are set forth in a four-page folder that is entitled, "Wake Up the Daylight in Walls and Ceilings."

**Electric Furnaces with Internal Heaters.** Automatic and Electric Furnaces, Ltd., 173-175 Farringdon Road, London, E. G. 1. The leaflet describes the electric furnaces that can be used for heat treatment of metals, carburizing mild steel, japanning, vitreous enameling, glass annealing, color burning, debritting iron before galvanizing graphitizing, calorizing, bonding materials and other industrial processes.

**Die Heads.** The Landis Machine Co., Waynesboro, Pa. The Land-Matic die head and the many types of work that it will do is explained. Illustrations of the appliance at work in various shops are shown.

**Gears.** The Boston Gear Works Sales Co., Norfolk Downs, Quincy, Mass. Many of the products of the Boston Gear Works are listed, described and priced in this catalog just issued.

## Pamphlets Received

**Tests of Some Girder Hooks.** The Bureau of Standards, Department of Commerce, Washington, D. C. This is technologic paper No. 260 and has been prepared by Herbert L. Whittemore and Ambrose H. Strang. Diagrams show the results of recent tests on usual and unusual hooks.

**Relation of Fuel-Air Ratio to Engine Performance.** The National Advisory Committee for Aeronautics. The Government Printing Office, Washington, D. C. Report No. 189, prepared by Stanwood W. Sparrow of the Bureau of Standards, sets forth the findings of this investigation.

**Physical Properties of Materials.** Department of Commerce, Washington, D. C. This is an exhaustive study of the subject with many diagrams, charts, tables and illustrations. There are two hundred and four pages in the pamphlet.

**Flame Speed and Spark Intensity.** The Government Printing Office Washington, D. C. This is report No. 187 of the National Advisory Committee for Aeronautics and was prepared by D. W. Randolph and F. B. Silsbee of the Bureau of Standards.

## Forthcoming Meetings

**National Safety Council.** Thirteenth Annual Safety Congress. Louisville, Ky. Sept. 29 to Oct. 3. W. H. Cameron, managing director, 168 N. Michigan Ave., Chicago.

**Motor and Accessory Manufacturers' Association.** Annual meeting, Cleveland, Ohio. Week of Oct. 6, 1924.

**American Foundrymen's Association.** Twenty-eighth annual convention, Milwaukee, Wis. Week of Oct. 13, 1924.

**National Industrial Advertisers Association.** Annual meeting, Edgewater Beach Hotel, Chicago, beginning Oct. 13, 1924.

**Management Week.** Under the auspices of the American Society of Mechanical Engineers. Week of Oct. 20, 1924. Simultaneously held in leading cities.

**American Gear Manufacturers Association.** Semi-annual fall meeting. Briarcliff Lodge, Briarcliff Manor, N. Y., Oct. 16, 17 and 18. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

**Society of Automotive Engineers.** Production meeting. General Motors Building, Detroit, Mich., Oct. 22, 23 and 24. C. S. Clarkson, secretary.

**American Society of Mechanical Engineers.** Forty-fifth annual meeting. New York City. Dec. 1 to 4. Calvin Rice, secretary, 29 West 39th St., New York City.

**National Exposition of Power and Mechanical Engineering.** Grand Central Palace, New York City, Dec. 1 to 4. Charles F. Roth, 1102 Grand Central Palace Building, New York City.

**Exposition of Invention.** Engineering Societies Building, 29 West 39th St., New York City. Dec. 8 to 13 inc., General offices, 47 West 34th St., New York City.

# The Weekly Price Guide

## *Rise and Fall of the Market*

**Iron and Steel**—Pig iron market quiet; buying confined to small lots. No accumulation of reserve iron stocks. No. 2 foundry, Southern, still $18@$18.50 per ton; unchanged in week. Trend of steel prices continues downward. Wire products, steel sheets and wrought pipe are the principal items affected by abolition of Pittsburgh Plus. Bars are quoted at $2@$2.10 per 100 lb., Pittsburgh; shapes, $1.90@$2 and plates, $1.60@$1.90; no changes having occurred during the week. Tin plate is in fair demand in the current market. Heavy melting steel advanced 50c. per ton in New York during month.

**Non-Ferrous Metals**—Lead is the only one of the major metals to show price fluctuations since Sept. 19; price down ¼c. per lb. in New York. Copper inquiry and sales improved during week. Zinc market trifle firmer. Antimony also firm but inactive.

**Linseed Oil**—Raw oil dropped another cent per lb. in New York during week, price now $1.03 per gal. in 5 bbl. lots, f.o.b.

(All prices as of Sept. 25)

## IRON AND STEEL

**PIG IRON**—Per gross ton—Quotations compiled by The Matthew Addy Co.:

| | |
|---|---|
| CINCINNATI | |
| No. 2 Southern | $22.05@22.55 |
| Northern Basic | 20.00 |
| Southern Ohio No. 2 | 21.77 |
| NEW YORK—Tidewater Delivery | |
| Southern No. 2 (silicon 2.25@2.75) | 28.05 |
| BIRMINGHAM | |
| No. 2 Foundry | 18.00@18.50 |
| PHILADELPHIA | |
| Eastern Pa., No. 2x (silicon 2.25@2.75) | 21.77@22.27 |
| Virginia No. 2 | 28.44@29.44 |
| Basic | 20.00@21.00 |
| Grey Forge | 21.22 |
| CHICAGO | |
| No. 2 Foundry local | 20.00 |
| No. 2 Foundry, Southern (silicon 2.25@2.75) | 25.05 |
| PITTSBURGH, including freight charge from Valley | |
| No. 2 Foundry | 22.77 |
| Basic | 22.77 |
| Bessemer | 25.26 |

**IRON MACHINERY CASTINGS**—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

| | |
|---|---|
| Detroit | 4.75 |
| Cleveland | 4.75@5.00 |
| Cincinnati | 5.00@7.50 |
| New York | 5.00@5.50 |
| Chicago | 5.25@5.75 |

**SHEETS**—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

| Blue Annealed | Pittsburgh Mill Base | New York | Cleveland | Chicago |
|---|---|---|---|---|
| No. 10 | 2.65@2.70 | 3.89 | 3.45 | 3.80 |
| No. 12 | 2.75@2.80 | 3.94 | 3.50 | 3.95 |
| No. 14 | 2.85@2.90 | 3.99 | 3.55 | 4.00 |
| No. 16 | 3.05@3.10 | 4.09 | 3.65 | 4.10 |
| Black | | | | |
| Nos. 17 and 21 | 3.25@3.35 | 4.40 | 4.15 | 4.55 |
| Nos. 22 and 24 | 3.30@3.40 | 4.45 | 4.20 | 4.55 |
| Nos. 25 and 26 | 3.35@3.45 | 4.50 | 4.25 | 4.60 |
| No. 28 | 3.40@3.50 | 4.60 | 4.35 | 4.50 |
| Galvanized | | | | |
| Nos. 10 and 11 | 3.55@3.60 | 4.60 | .... | 4.60 |
| Nos. 12 and 14 | 3.65@3.70 | 4.70 | .... | 4.70 |
| Nos. 17 and 21 | 3.95@4.00 | 5.00 | .... | 5.00 |
| Nos. 22 and 24 | 4.10@4.15 | 5.15 | 3.00 | 5.15 |
| No. 26 | 4.25@4.30 | 5.30 | 4.15 | 5.30 |
| No. 28 | 4.55@4.60 | 5.60 | 5.45 | 5.50 |

**WROUGHT PIPE (Welded)**—Warehouse discounts are as follows:

| | New York Black | New York Galv. | Cleveland Black | Cleveland Galv. | Chicago Black | Chicago Galv. |
|---|---|---|---|---|---|---|
| 1 to 3 in. steel butt welded | 48% | 34% | 55½% | 43½% | 56% | 43% |
| 2½ to 6 in. steel lap welded | 44% | 30% | 53½% | 40½% | 53% | 40% |

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

**SEAMLESS STEEL TUBING**—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

| O.D. Inches | List Price per ft. | Differential Discount | O.D. Inches | List Price per ft. | Differential Discount |
|---|---|---|---|---|---|
| ¼ | $0.09 | 50% | ⅞ | $0.16 | 35% |
| ⅜ | .11 | 45% | 1 | .18 | 31% |
| ½ | .14 | 40% | | | |

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

**MISCELLANEOUS**—Warehouse prices in cents per pound in 100-lb. lots:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Open hearth spring steel (base) | 4.50 | 6.00 | 4.20 |
| Spring steel (light) (base) | 7.00 | 6.00 | 6.00 |
| Coppered Bessemer rods (base) | 7.50 | 8.00 | 6.55 |
| Hoop steel | 4.49 | 4.35 | 4.15 |
| Cold rolled strip steel | 7.00 | 8.25 | 7.15 |
| Floor plates | 5.55 | 4.60 | 5.50 |
| Cold drawn shafting or screw | 4.15 | 3.90 | 3.80 |
| Cold drawn flats, squares | 4.65 | 4.40 | 4.30 |
| Structural shapes (base) | 3.34 | 3.20 | 3.10 |
| Soft steel bars (base) | 3.24 | 3.10 | 3.00 |
| Soft steel bar shapes (base) | 3.24 | 3.11 | 3.00 |
| Soft steel bands (base) | 3.99 | 3.20 | 3.65 |
| Tank plates (base) | 3.34 | 3.42½ | 3.10 |
| Bar iron (2.90@3.00 at mill) | 3.24 | 3.21 | 3.00 |
| Tool steel | 11.00 | .... | .... |
| Drill rod (from list) | 60% | 55% | 50% |

Electric welding wire, New York, 3/32, 8.35c.; 1/8, 7.85c.; 5/32 to 1/4, 7.35c. per lb.

## METALS

Current Prices in Cents Per Pound

| | | | |
|---|---|---|---|
| Copper, electrolytic (up to carlots), New York | | | 13.75 |
| Tin, 5-ton lots, New York | | | 48.50 |
| Lead (up to carlots), St. Louis | 7.85 | New York | 8.50 |
| Zinc (up to carlots), St. Louis | 6.15 | New York | 7.00 |

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Aluminum, 98 to 99% ingots, 1-15 ton lots | 27.10 | 28.00 | 28.50 |
| Antimony (Chinese), ton spot | 12.00 | 13.25 | 10.00 |
| Copper sheets, base | 20.62½ | 21.37½ | 23.00 |
| Copper wire, base | 19.00 | 19.00 | 21.75 |
| Copper bars, base | 19.87½ | 22.25 | 22.50 |
| Copper tubing, base | 22.75 | 28.00 | 25.75 |
| Brass sheets, base | 17.25 | 21.75 | 19.75 |
| Brass tubing, base | 21.50 | 28.00 | 28.25 |
| Brass rods, base | 15.00 | 17.75 | 17.50 |
| Brass wire, base | 17.75 | 21.75 | 20.25 |
| Zinc sheets (casks) | 10.60 | 11.10 | .... |
| Solder (½ and ½), (case lots) | 38.00 | 32.50 | 30.00 |
| Babbitt metal (83% tin) | 60.00 | 57.00 | 48@52 |
| Babbitt metal (35% tin) | 28.00 | 18.50 | 23@26 |
| Nickel (ingot and shot) f.o.b. refinery | 27.00 | .... | .... |
| Nickel (electrolytic) f.o.b. refinery | 30.00 | .... | 35.00 |
| Nickel (F shot) f.o.b. refinery | 30.00 | .... | .... |

**SPECIAL NICKEL AND ALLOYS**—Price in cents per lb., f.o.b. Huntington, W. Va.:

| | |
|---|---|
| Rolled nickel sheet (base) | 52.00 |
| Hot rolled rods, Grade "A" (base) | 50.00 |
| Cold drawn rods, Grade "A" (base) | 58.00 |

# Shop Materials and Supplies

## METALS—Continued

Manganese nickel hot rolled rods "E"—low manganese (base) 54.00
Manganese nickel hot rolled rods "D"—high manganese (base) 57.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

| | | | |
|---|---|---|---|
| Shot | 32.00 | Hot rolled rods (base) | 40.00 |
| Blocks | 32.00 | Cold drawn rods (base) | 48.00 |
| Ingots | 38.00 | Hot rolled sheets (base) | 42.00 |

**OLD METALS**—Dealers' purchasing prices in cents per pound

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Crucible heavy copper | 10.75@11.25 | 11.00 | 11.00 |
| Copper, heavy, and wire | 10.50@11.00 | 10.50 | 10 50 |
| Copper, light, and bottoms | 9.25@ 9.50 | 9.25 | 9.50 |
| Heavy lead | 6.25@ 6.50 | 6.00 | 7.00 |
| Tea lead | 5.25@ 5.50 | 4.50 | 5.50 |
| Brass, heavy, yellow | 6.50@ 6.75 | 6.50 | 7.00 |
| Brass, heavy, red | 8.50@ 8.75 | .... | 8.50 |
| Brass, light | 5.50@ 5.75 | 5.50 | 6.00 |
| No. 1 yellow rod turnings | 7.00@ 7.50 | 7.25 | 7.00 |
| Zinc | 3.75@ 4.00 | 3.75 | 3.50 |

**TIN PLATES**—American Charcoal—Bright—Per box.

| | | New York | Cleveland | Chicago |
|---|---|---|---|---|
| "AAA" Grade: | | | | |
| IC, | 20x28, 112 sheets | $23.50 | $22.85 | $21.00 |
| "A" Grade: | | | | |
| IC, | 20x28, 112 sheets | 19.00 | 18.80 | 17.00 |
| | Coke Plates—Primes, 20x28 in. | | | |
| 100-lb., | 112 sheets | 13.00 | 13.00 | 12 75 |
| | Terne Plates—Small lots, 8-lb. Coating | | | |
| IC, | 14x20 | 7.25 | 6.80@6.90 | 6.50@6.75 |

## MISCELLANEOUS

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Cotton waste, white, per lb. | $0.14@0.21 | $0.19 | $0.14 |
| Cotton waste, colored, per lb. | .09@ .14½ | .18 | .10½ |
| Wiping cloths, 13¼x13¼, per lb | 11.25* | 36.00 per M | .16 |
| Wiping cloths, 13½x20½, per lb. | .... | 50.00 per M | .16 |
| Sal soda, per 100 lb. | 2.40 | 2.25 | 2.65 |
| Roll sulphur, per 100 lb. | 3.60 | 3.25 | 3.50 |
| Linseed oil, per gal., 5 bbl. lots | 1.03 | 1.16 | 1.05 |
| Lard cutting oil, 25% lard, per gal. | .55 | .50 | .32 |
| Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal. | .29 | .35 | .21 |
| Belting—Present discounts from list in fair quantities (½ doz. rolls). | | | |
| Leather—List price, 24c. per lin. ft. per inch of width for single ply. | | | |
| Medium grade | 40–2½% | 40–10% | 30–10% |
| Heavy grade | 30–5% | 30% | 20–5–2½% |
| Rubber transmission: | | | |
| First grade | 50% | 50–10% | 40–10% |
| Second grade | 50–10% | 60–5% | 60–5% |
| Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets: | | | |
| Flint paper | $4.86 | $5.84 | $6.48 |
| Emery paper | 10.71 | 11.00 | 8.80 |
| Emery cloth | 28.00 | 31.12 | 29.48 |
| Emery disks, 6 in. dia., No. 1 grade, per 100: | | | |
| Paper | 1.49 | 1.24 | 1.40 |
| Cloth | 3.38 | 2.67 | 3 20 |
| Fire clay, per 100 lb. bag | .... | .65 | .60 |
| Coke, prompt furnace, Connellsville | per net ton | | 3.00@3.25 |
| Coke, prompt foundry, Connellsville | per net ton | | 4.25@4.75 |
| White lead, dry or in oil | 100 lb. kegs | | New York, 14.75 |
| Red lead, dry | 100 lb. kegs | | New York, 14.75 |
| Red lead, in oil | 100 lb. kegs | | New York, 16.25 |

*White, at washery.

## *Comparative Warehouse Prices*

| New York | Unit | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|---|
| Soft steel bars | per lb. | $0.0324 | $0.0324 | $0.0354 |
| Cold finished shafting | per lb. | 0.0415 | 0.0415 | 0.0465 |
| Brass rods | per lb | 0.15 | 0.15 | 0.1575 |
| Solder (½ and ½) | per lb. | 0.38 | 0.385 | 0.295 |
| Cotton waste | per lb. | .14@.21 | .14@.21 | 10@13 |
| Washers, cast iron (½ in.) | per 100 lb. | 6.50 | 6.50 | 6.50 |
| Emery, disks, cloth, No. 1, 6 in. dia. | per 100 | 3.38 | 3.38 | 3.38 |
| Lard cutting oil | per gal. | 0.55 | 0.55 | 0.55 |
| Machine oil | per gal. | 0.29 | 0.29 | 0.297 |
| Belting, leather, medium | off list | 40–2½% | 40–2½% | 30–10% |
| Machine bolts up to 1x30 in. | off list | 50% | 50% | 40–10% |

## SHOP SUPPLIES

Current Discounts from Standard Lists

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Machine Bolts: | | | |
| All sizes up to 1x30 in. | 50% | 60% | 60% |
| 1½ and 1½x3 in. up to 12 in | 15% | ..... | .... |
| With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%) | 40% | $3.50 net | ..... |
| With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%) | 45% | 3.50 net | 60%* |
| Button head bolts, with hex. nuts | 10% | 3.50 net | ..... |
| Hex. head and hex. nut bolts | 10% | ..... | ..... |
| Lag screws, coach screws | 50% | ..... | 65% |
| Square and hex. head cap screws | 75% | 75–10% | ..... |
| Carriage bolts, up to 1 in. x30 in. | 40% | 60% | 55% |
| Bolt ends, with hot pressed nuts | 50% | ..... | 60% |
| Tap bolts, hex. head, list plus | 35% | ..... | $4.65 |
| Semi-finished nuts, ⅞ and smaller | 70% | ..... | ..... |
| Semi-finished nuts, ¾ and larger | 65% | 70% | ..... |
| Case-hardened nuts | 50% | ..... | ..... |
| Washers, cast iron, ½ in., per 100 lb. (net) | $6.50 | $4.00 | $3.75 |
| Washers, cast iron, ¾ in., per 100 lb. (net) | 5.50 | 4.00 | 3.75 |
| Washers, round plate, per 100 lb. Off list | 1.50 | 4.75 | 4.50 |
| Nuts, hot pressed, sq., per 100 lb. Off list | 1.50 | 4.00 | 4.00 |
| Nuts, hot pressed, hex., per 100 lb. Off list | 1.50 | 4.00 | 4.00 |
| Nuts, cold punched, sq., per 100 lb. Off list | 1.50 | 4.00 | 4.00 |
| Nuts, cold punched, hex., per 100 lb. Off list | 1.50 | 4.00 | 4.00 |
| Rivets: | | | |
| Rivets, ⅞ in. dia. and smaller | 50% | 60–10% | 70% |
| Rivets, tinned | 50% | 60–10% | 70% |
| Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net) | $5.00 | $3.50 | $3.50 |
| Cone heads, ditto (net) | 5.20 | 3.60 | 3.70 |
| 1½ to 2-in. long, all diameters, *EXTRA* per 100 lb. | 0.25 | ..... | 0.15 |
| ¾ in. diameter *EXTRA* | 0.35 | ..... | 0.15 |
| ½ in. diameter *EXTRA* | 0.75 | ..... | 0.50 |
| 1 in. long, and shorter *EXTRA* | 0.75 | ..... | 0.50 |
| Longer than 5 in. *EXTRA* | 0.50 | ..... | 0.25 |
| Less than 200 lb. *EXTRA* | 0.50 | ..... | 0.50 |
| Countersunk heads *EXTRA* | 0.45 | ..... | ... |

*Square.

# Machine Requirements and Industrial Construction

## Machine Tools and Equipment Wanted

**Calif., Los Angeles**—Bd. Pub. Wks.—5 ton electric traveling crane for garbage loading station.

**Conn., Groton**—New London Ship & Engine Co.—electric crane of large capacity.

**Mass., Boston**—City, Schoolhouse Dept., City Hall—metal and woodworking machinery for Manual Training Dept., in the new $400,000 addition to the Washington Irving School, Rosindale.

**Mass., Lowell**—W. Hebes, P. O. Box 1077—surface grinder, power feed drill press, sharper, 14 x 6 engine lathe with equipment.

**Mass., Newburyport** — School Board — metal and woodworking machinery for manuel training dept. of new $500,000 high school.

**Mass., Worcester**—Simonds Saw & Steel Co., 470 Main St.—machinery for new manufacturing plant unit.

**Mo., St. Louis**—Bd. of Education, 911 Locust St., R. M. Milligan, Bldg. Comr., receiving bids until Oct. 8, for manual training equipment, including lathe, woodworking machinery, etc., for the Jefferson grade schools.

**N. J., Trenton Junction** (Trenton P. O.)—State Dept. of Institutions and Agencies, B. G. Lewis, Comr., State House—machinery for proposed new workshop.

**N. Y., Howe Cave**—F. L. Casper—one 26 in. finishing planer with sectional feed, etc.

**N. Y., New York**—Hyro Mfg. Co. Inc., 352 West 13th St.—power squaring shear 4 or 5 ft. long, capacity ¼ in. plate.

**W. Va., Charleston**—Moore Lumber Co., J. W. Moore, Pres.—American log leader, 42 in. track gauge.

**W. Va., Logan**—Guyan Machine Shops—15 ton arbor press, and 250 to 300 ton wheel press.

**Wis., Milwaukee**—Metal Ornaments Co., c/o G. Affeld, 105 Wells St., (aluminum articles)—stamping press.

**Wis., Wauwatosa**—Tully & Hauber, 194 West Main St.—lathe, drill press, etc., for garage.

**Ont., St. Marys**—Motor Wheels Limited, B. E. Seymour, Mgr.—equipment for plant for the manufacture of special patent wheels for motor cars. Estimated cost $25,000.

**Ont., Toronto**—Bedford Machine Tool Co., 166 Bedford Road—equipment for 40 x 60 ft. plant on Kendal Ave.

**Ont., Warsaw** — Selkirk & Henderson, Wm. Selkirk, Purch. Agt.—lathe, portable drill.

**Que., Cabano** — Garage Central, J. N. Gauvin, Purch. Agt.—drill and small lathe.

**Que., Cabano**—O. Paradis—drill, lathe, grinder and miscellaneous tools.

**Que., Montreal**—Sticht Architectural Iron & Bronze Works, Ltd., S. C. Foster, 101 Belgrave Ave., Secy.—complete equipment for workshops manufacturing grills, stairs, railings, cages, castings, etc.

**Que., Notre Dame du Lac**—L. L. Dube (sash and door mfg.)—planer and matcher.

**Que., St. Constant**—Patenande Co.—complete equipment for coffin manufacturing.

**Que., Trois Pistoles**—L. D'Amours—rotary saws, lathe machines, etc.

## Opportunities for Future Business

**Calif., Alameda** — J. H. Baxter & Co., American Bank Bldg., San Francisco, plans the construction of a creosote plant, lumber and coal yard. Estimated cost $250,000.

**Calif., Los Angeles** — The Engineering Dept. of the Municipal Power Bureau, is preparing plans for shops and warehouses in connection with their program for extending and improving the electric and power distributing systems, for which $16,000,000 bond issue was recently voted.

**Calif., Los Angeles**—Miller & Gilbert, 407 Merritt Bldg., are having plans prepared for the construction of a 9 story, 100x125 ft. garage at 6th and Carlondelet Sts.

**Calif., Marysville**—C. Powell, 216 Third St., plans the construction of a machine shop on 3rd St. Estimated cost $5,000 or more.

**Conn., Bristol** — E. Engraham & Co., (clocks) 392 North Main St., is receiving bids for the construction of a 2 story, 200 x 65 ft. factory building. Estimated cost $40,000. H. A. Hayden, 175 Main St., Archt. Noted Aug. 28.

**Conn., Groton**—New London Ship & Engine Co., plans the construction of a 200 x 60 ft. fabricating factory with 350 x 105 ft. outside steel skeleton for electric crane. Cost will exceed $40,000.

**Ill., Decatur** — Mississippi Valley Structure Steel Co., R. D. Wood, Gen. Mgr., will build a 1 story, 150 x 500 ft. steel plant warehouse. Bridge cranes and other machinery will be installed. Private plans.

**Ia., Sioux City**—Sioux City Terminal Ry. Co., awarded the contract for the construction of a 1 story, 100 x 150 ft. engine house and machine shop building.

**Mass., Boston** — E. Clayton, 11 Beacon St., will build a 2 story 20,000 sq.ft. garage, showroom and stores at 5-15 Madison Court. Estimated cost $200,000. Silverman, Brown & Heenan, 51 Cornhill, Archts.

**Mass., Boston**—Queensberry Realty Trust Co., 18 Tremont St., will build a 1 and 2 story 200 x 100 ft. garage at 59-75 Queensberry St. Estimated cost $160,000. G. M. Jacobs, 4 Park St. Archt.

**Mass., Brockton** — A. Grindin, awarded the contract for the construction of a 1 and 2 story repair and service garage on Crescent St. Estimated cost $45,000.

**Mass., Dorchestetr Sta.** (Boston P. O.)—Stilphen Motor Co., 395 Columbia Road, awarded the contract for the construction of a 1 story, 17,000 sq.ft. repair and service garage, 450 Columbia Road. Estimated cost $40,000.

**Mass., Medford**—A. Fanci, 15 Yale St., plans the construction of a 1 story, 185 x 185 ft. garage, show room and repair shop, at Mystic Ave. & Hancock St. Estimated cost $150,000. W. H. Fopiano, c/o Andrews, Jones, Biscoe & Whitmore, 60 Congress St., Boston, Archt.

**Mass., New Bedford**—E. Caswell, 490 Pleasant St., is having plans prepared for the construction of a 2 story, 125 x 140 ft. repair and service garage building on Purchase St. Cost will exceed $100,000. F. T. Hammond, 490 Pleasant St., Archt.

**Mass., Worcester** — Johnson & Bassett Inc., Foster St., manufacturers of textile machinery, awarded the contract for the construction of a 6 story, 30 x 90 ft. factory on Manchester St. Estimated cost $65,000 to $75,000.

**Mich., Detroit** — Whitney Estate, c/o Smith, Hinchman & Grylls, 800 Marquette Bldg., Archts., are having plans prepared for the construction of a 4 story, 100 x 200 ft. garage, at Adams & Randolph Sts.

**Mo., St. Louis**—Chandeysson Electric Co., 4092 Bingham Ave., awarded the contract for the construction of a 1 story, 50 x 121 ft. shop building on Bingham Ave. Estimated cost $50,000.

**N. J., Trenton Junction** (Trenton P. O.)—State Dept. of Institutions and Agencies, B. G. Lewis, Comr., State House, will soon receive bids for additional buildings including a workshop for New Jersey School for the Deaf. Estimated cost $500,000. A. B. Mills, State Office Bldg., 135 West Hanover St., Engr.

**O., Cleveland** — Bender Body Co., 6209 Barberton Ave., has plans completed for a 1 story, 77 x 150 ft. factory building. Estimated cost $40,000. Private plans.

**O., Cleveland**—The Carey Machine Co., F. J. Schmodt, Secy., 5606 Curtiss Ave., having plans prepared for the construction of a machine shop, 90 x 122 ft. Estimated cost $50,000. E. McGeorge, 3030 Euclid Ave., Archt. and Engr.

**Pa., Corry**—Corry Jamestown Mfg. Co., (sheet metal specialties), having plans prepared for a 4 story, 61 x 131 ft. addition to factory. Estimated cost $65,000. O. Johnson, Jamestown, N. Y., Archt.

**Pa., Florin**—Raymond Mfg. Co., Corry, (springs), awarded the contract for a 2 story, 95 x 60 ft. factory addition. Estimated cost $40,000.

**Pa., Philadelphia** — Gulf Refining Co., Weidener Bldg., awarded the contract for the construction of a 2 story, 100 x 60 ft. and a 1 story, 100 x 160 ft. workshop on Penrose Ave., east of Schuylkill River. Estimated cost $70,000.

**Pa., Whites Ferry**—St. Michaels Industrial School, receiving bids until Oct. 7, for the construction of a 2 story, 98x50 ft., shop. E. G. Perrot, 1211 Arch St., archt.

**Wis., Madison**—The Jacobson Auto Co., 207 East Washington Ave., plans the construction of a 3 story garage and repair shop on Gorham St. Estimated cost $150,000. Architect not selected.

**Wis., Marinette**—M. & M. Paper Co., had awarded the contract for the construction of a 1 story, 42 x 280 ft. machine shop. Estimated cost $60,000.

**Wis., Milwaukee**—G. J. Meyer Mfg. Co., 576 Clinton St. (bottle cleaning machinery) awarded the contract for the construction of a 1 story, 80x100 ft. addition to shop on Clinton St. Estimated cost $40,000.